

FLEMING'S
PRACTICAL
HORSE-SHOEING

J. MACQUEEN

ELEVENTH EDITION

1921

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ELEVENTH EDITION

REVISED AND EDITED BY

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LONDON

BAILLIÈRE, TINDALL AND COX

8, HENRIETTA STREET, COVENT GARDEN

1921 (REPRINTED)

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PRINTED IN GREAT BRITAIN

PREFACE TO THE ELEVENTH EDITION

THE demand for another—the eleventh—edition of Fleming's "Practical Horse-Shoeing" may be accepted as indicating the continued popularity of the principles of farriery so clearly presented by the author of the following pages.

In this edition no alteration has been made in the plan of the Essay, which was designed mainly for the information of farriers and of others, outside the veterinary profession, more or less interested in the shoeing of horses. A few additions and corrections rendered necessary by the lapse of time and its concomitants have been made and the number of illustrations has been increased, but no attempt has been made to deal with pathological shoeing, a subject which belongs to the province of the Veterinary Surgeon.

J. MACQUEEN.

ROYAL VETERINARY COLLEGE,
LONDON.
March 5th, 1916.

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PRACTICAL HORSE-SHOEING

IMPORTANCE OF THE ART

VERY little observation and reflection are required, in order to arrive at the conclusion that the art of "Horse-Shoeing" is an important one, so far as civilization and the ordinary everyday business of life are concerned ; and that the successful utilization of the horse, together with his welfare and comfort, in a great measure depend upon the correctness of the principles on which its practice is based, and the mode in which these principles are carried out by the farrier.

For proof of this, we need only glance at the traffic in our great towns and cities, and recall the prominent part played by the horse in agriculture and in military service ; at the same time remembering that, without a defence to its hoofs, the horse would be almost—if not quite—valueless, in consequence of the hardness of our artificial roads, and the great efforts demanded from him ; or, studying the anatomy and functions of the limbs and feet, to see how these are wonderfully calculated to serve most essential purposes in locomotion and weight-sustaining, and how necessary it is at the same time that their natural adaptability be as little as possible thwarted or annulled by the

interference of man, in his endeavour to protect or aid them.

From the earliest ages, the horse's foot and its envelope, the hoof, have been looked upon by horsemen as the principal region of the animal's body to which care and attention should be directed : as when these become injured or diseased—no matter how perfect and sound the other parts may be—the quadruped's services are diminished or altogether lost.

Consequently, the preservation of these in an efficient and healthy state has ever been the aim of those who valued the horse for the immense advantages his services were capable of conferring on mankind ; and, in later years, those who have been moved by the sacred impulse of humanity towards the lower creatures, have not forgotten how much this noble animal may suffer from unskilful management of its feet, through the neglect or ignorance of those who have the special care of these organs.

At a very early period in the domestication of the horse, and particularly in Western regions, it must have been soon discovered that at certain seasons, on particular soils, and especially when called upon to perform any great amount of travelling and load-carrying, the horn of the unshod hoof was worn away faster than it could be renewed ; and that the living sensitive structures within, becoming exposed or irritated by contact with the ground, were injured, causing pain and lameness, and for a time unfitting the horse for further work.

To guard against this serious and certain result, the ingenuity of man must have been severely tested

in devising a suitable and durable protection for the ground surface of the hoof; and among the many contrivances proposed, the most notable, and by far the most valuable, has been the device of nailing a plate of metal to the outer margin or *wall* of the hoof.

The antiquity of this invention is very great; and it is probable that for many centuries the shoe was considered as nothing more than a simple defence of the hoof from the damaging effects of wear, and occasionally as an aid in securing the animal's foothold during progression on slippery ground.

As time advanced, however, and the services of the horse became increased a hundredfold by resorting to this ingenious yet simple expedient, the sciences of anatomy and physiology began to embrace the horse in their domain; and, crude as they were at first, it is to be feared that when they were extended to the investigation of the structure and functions of the foot, the useful and comparatively harmless protection of early days was made subservient to the most varied and fantastic theories. For it must be admitted that, for many years, horse-shoeing, instead of proving a boon to horse-owners and a preserver of horses' feet, was far from yielding the benefits its scientific and reasonable application might have been expected to afford; indeed, it would be no exaggeration to assert that the predominating principles and practice of this art were eminently destructive to horses, and a source of great loss to their owners.

These principles were founded on a misconception of the functions of the foot, and of the part assumed by the hoof in locomotion; and their extensive adoption

was due to the fact that they were congenial to the whims of fashion, and were deemed essential to the improvement of nature : commending themselves to unreasoning and unreasonable minds, like the cropping of horses' and dogs' ears, cutting, nicking, and docking tails, and other questionable practices.

The amount of injury inflicted by a faulty method of shoeing may be very much greater than a cursory examination of the foot would lead one to believe. To those experienced among horses, and who have directed their attention closely to the subject, the proportion of animals whose utility is directly or indirectly impaired by improper treatment of their feet must appear excessive, when compared with the other causes of inefficiency. Indeed, maladies of the feet and limbs, due, more or less, to bad shoeing, form a considerable percentage of the cases of lameness usually met with in veterinary practice.

An art, therefore, which has so much influence for good or evil, so far as the usefulness of the horse is concerned, surely merits the serious study of those who are interested in that animal. A good system, founded on the teachings of anatomy and physiology, and perfected by daily experience, must prove of immense benefit to horse and owner ; while a bad system, conducted in ignorance, carelessness, or mistaken notions, must sooner or later lead to lameness and more or less uselessness of the animal, and loss or inconvenience to its owner.

ANATOMY OF THE HORSE'S FOOT

One of the primary considerations for those who have the shoeing and management of the horse's foot should be the acquisition of a knowledge of its structure and functions in health : not a profound knowledge, certainly, such as the scientific veterinarian requires, but sufficient to enable them to understand the situation, relation, texture, and uses of the parts of the organ with which they have more particularly to deal. If the farrier does not possess this knowledge, is it possible that he can practise his handicraft to advantage, or minister effectually to the varied requirements of this organ? By many farriers the foot of the horse is looked upon as little, if anything, more than an insensible block of horn which they may carve and mutilate with impunity, and as suits their fancy, and for which nothing more is necessary than the attachment to it, by a number of nails, of a clumsy piece of iron that may not only be unsuitable for its requirements, but positively injurious to it and the other parts of the limb. The art of farriery in this country has never received adequate recognition, nor has it been developed scientifically, and in consequence it has largely been in practice a mere affair of routine and tradition. Such should not be the case ; and allusion is only made to this matter here in order to urge most strenuously the necessity for farriers being properly instructed in the elements of their art, and made to comprehend as much as may be required of the construction and functions of the horse's foot

upon which they are destined to exercise their skill.

The foot of the horse may be said, for practical purposes, to be intended not only as an organ of support and defence (or offence), but also as that part of the limb in which certain efforts initiated elsewhere

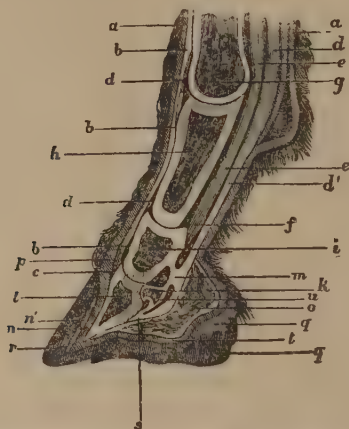


FIG. 1.—SECTION OF THE HORSE'S FOOT. *a a*, Skin of leg. *b b b*, Extensor tendon of foot; *c*, its insertion into the foot bone. *d d*, Capsular ligament of joints. *d' d'*, Flexor tendon of foot inserted into sole of foot bone (*s*). *e e*, Flexor tendon of pastern inserted at *f* into the small pastern bone (*i*). *g*, Shank or large metacarpal bone. *h*, Large pastern bone. *k*, Navicular bone. *l*, Foot or pedal bone. *m*, Ligaments of navicular bone connected with deep flexor tendon. *n*, Sensitive laminae, dovetailing with horny laminae, *n'*. *o*, Plantar cushion. *p*, Coronary cushion. *q*, Horny frog. *r*, Wall of hoof. *t*, Sensitive membrane of frog and sole. *u*, The face of the navicular bone over which the flexor tendon passes—the seat of navicular disease.

are concentrated, and as the instrument through which propulsion and progression may be mainly effected. Although the foot is endowed, in a natural

state, with the sense of touch, which enables the horse to travel with confidence and safety at all paces on rough as well as smooth, and on soft as well as hard ground, the hoof itself is insensitive, and its rôle in this regard is limited to transmitting impressions of contact to the sensitive structures within the horn.

The foot, methodically and carefully examined, will be found to have for its basis the last three bones of the limb—the small pastern (Fig. 1, *i*), navicular (*k*), and pedal or coffin bone (*l*). The pedal bone is more particularly the foundation of the foot, and is the nucleus on which the hoof is moulded, and which in shape it somewhat resembles. Into its highest point in front, the large extensor tendon of the foot is inserted (*c*), and in the middle of its lower face, or sole, is implanted the powerful tendon which bends or flexes the foot (*d'*, *d'*, *s*). An elastic apparatus supports and protects the flexor tendon and a portion of the pedal bone, and the whole is enveloped by a membrane that attaches the hoof in the closest possible manner to its outer surface. Into each of the wings or sides of the pedal bone, which is crescent-shaped, the horns extending backward on each side, is fixed a large plate of fibro-cartilage that rises above the hoof, where it may readily be felt; this plate has important relations with its fellow on the opposite side, as well as with other elastic bodies admirably disposed to sustain weight, prevent jar, and insure that lightness and springiness which form a striking feature in the horse's movements. The navicular bone is a narrow piece, placed transversely between the wings of the coffin bone behind, and is intended

to throw the flexing tendon further from the centre of motion, and thus increase its power ; the tendon plays over its posterior or lower face, and this disposition, together with the relations established between it and the pedal bone through their connecting ligaments, and the bend the tendon makes in passing over it, cause this part of the foot to be one particularly liable to disease, and one especially deserving of study.

The elastic apparatus of the foot consists of (1) the two lateral cartilages just mentioned ; (2) a prominent

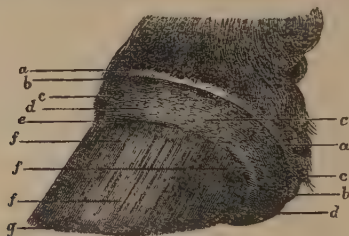


FIG. 2.—HORSE'S FOOT DIVESTED OF ITS HOOF. *a a*, Perioplic ring. *b b*, Perioplic or coronary fissure. *c c c*, Coronary cushion covered with villi. *d d*, White zone. *f f f*, Vascular or sensitive laminae (or leaves) terminating in villi (*g*).

ring or cornice surrounding the upper border of the pedal bone, and usually known as the “coronary band,” but which might be more aptly designated the “coronary cushion” (Figs. 1, *p*, 2, *c*) ; this fits into a corresponding groove in the inner and upper margin of the wall of the hoof, and, besides acting as an elastic body or cushion, it supports the membrane that secretes or forms the wall or crust of the horny envelope ; (3) a triangular fibro-elastic body—the plantar cushion (Figs. 1, *o*, 4, *b*, *f*), known to farriers as the “fatty”

or "sensitive frog" (to distinguish it from the horny frog, which immediately covers it), is admirably disposed between the wings of the coffin bone, with a view to protect and sustain the flexor tendon during its efforts, as well as to diminish concussion by its own resiliency (or springiness), and by the connection

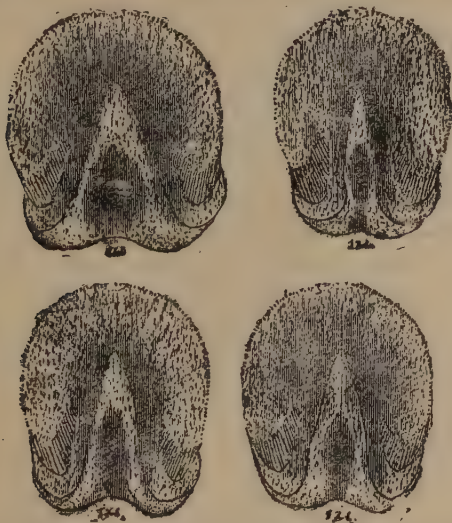


FIG. 3.—VARIATIONS IN THE DEVELOPMENT OF THE PLANTAR CUSHION. (From Peuch and Lesbre, "Pied du Cheval.")

it has with the lateral cartilages. From its position at the back of the foot, and the importance of the parts it covers, this portion of the elastic apparatus derives much interest, and must not be overlooked by the farrier. The plantar cushion is a very vascular body, and it contains, especially towards its base, groups of special nerve corpuscles which endow it with acute

sensibility to pressure. It is also furnished with numerous sudoriparous glands, which discharge their secretion into the cleft of the horny frog. Catarrh of these glands, with accumulation of the secretion in the cleft, constitutes the condition called "thrush."

Besides the elastic apparatus of the foot more immediately in connection with the pedal and navicular bones, there is the wonderful sensitive or horn-forming membrane enveloping these parts, and whose office appears to be the formation and attachment of the hoof. This membrane is deep red in colour, dense and resistant in texture, firmly adherent to the parts it covers, very vascular and highly sensitive, and it presents on its surface next the hoof numerous elevations which are either in the form of leaves (sensitive laminæ) or papillæ—the villi of the coronary band, sensitive sole and frog, and perioplic ring. To it large quantities of blood are conveyed by the terminal branches of the arteries proceeding to the foot, and that fluid is carried from it by a complex distribution of veins arising from these minute arterial divisions, to the venous trunks that pass up the limb. The terminal twigs of the nerves of sensation of the foot are also freely distributed in its substance, in the form of exceedingly fine filaments, which endow the foot with a sufficient sense of touch to enable it to perform its varied functions with safety and precision.

A peculiar and striking arrangement of the sensitive membrane can be observed around the front and sides of the pedal bone, when the hoof has been removed by steeping the foot for some time in water. The membrane appears folded into parallel vertical leaves,

which extend from the coronary cushion to the lower border of the bone, and to a certain distance within its wings (Figs. 1, *n*, 2, *f*, 4, *d*). These leaves, which resemble in appearance those on the under side of a mushroom, are known as the "vascular" or "sensitive laminæ," and number from 550 to 600; their chief use seems to be to afford a wide and close attachment for the wall of the hoof, within which, through



FIG. 4.—SENSITIVE SOLE OF HORSE'S FOOT. *a*, Bulbs of the heels, covered by sensitive membrane. *b*, Inflexion of the coronary cushion. *c*, Middle cleft or lacuna. *d d*, Plantar laminae. *e*, Limit between the coronary cushion and plantar laminae. *f f*, Branches of the plantar cushion. *g g g g*, Termination of the laminae in villi. *h h*, Sensitive membrane of sole covered with innumerable fine tufts or villi. *i*, Prolongation of the coronary cushion into the lateral lacuna.

their agency, the pedal bone is, as it were, suspended; so that the relations between bone and hoof are not so rigid and unyielding as if they were directly united to each other. These laminæ are exceedingly vascular and sensitive, and when they become inflamed through bad shoeing, excessive travelling, or other cause, the horse suffers great pain, and in a large majority of cases the chronic inflammation that remains produces

serious alterations in the condition of the foot, leading to more or less lameness, deformity, and diminished utility.

Besides entering into the formation of these leaves, this membrane covers the other parts of the foot within the hoof, as a sock does the human foot, and endows it with a high degree of vitality, sensation, and horn-forming power; it overspreads the coronary and plantar cushions, as well as the sole of the pedal bone, and its surface in these parts is thickly studded with myriads of tufts or "villi," which give it the appearance of the finest Genoa velvet (Fig. 4, *g*, *h*). These minute processes vary in length from 1 to 5 millimetres according to their position, and are best observed when a foot, from which the hoof has just been removed by steeping for a long time, is suspended in clear water. Examined with the microscope, they are found to be merely prolongations from the face of the membrane, each being composed of one or two minute arteries, which branch off into an exceedingly fine network, and end in delicate veins; nerve filaments have been traced into their substance; so that these tufts or villi are not only vascular, but sensitive. They are responsible for the formation of the horny wall, sole, and frog, and their relations to the hoof must not be neglected by the farrier in his treatment of it.

This is all that need be said at present with regard to the anatomy of the living parts of the horse's foot; we have referred to it merely to show that this organ is not a crude block of insensitive matter, but a most wonderfully constructed apparatus, possessed of qualities which are not to be found in any other part of

the body. In constructing the foot of the horse, nature sought to do more than merely protect the extremely delicate and exquisitely sensitive structures contained within the hoof from injurious contact with the ground. This aim is insignificant, in comparison with the other portions of the task she set herself. It was necessary that the lower extremity of the limb of the horse, should be an organ endowed with the sense of touch for the perception of the consistence and inequalities of the ground over which it moved ; and while it possessed this quality in a high degree, it was also indispensable that it should be provided with the properties of resistance, pliability, and lightness to the extent necessary for the support and progression of the body ; in addition to the rigidity essential to impulsion, the elasticity and suppleness needful to avert reactions or jar, and the durability and rapidity of renovation demanded by incessant wear. Here we have a combination of requirements whose simultaneous existence in one organ might almost be deemed incompatible, so opposite do they appear : insensibility with a delicate sense of touch ; resistance with lightness ; rigidity with elasticity ; and suppleness with durability.

THE HOOF

The " hoof " takes no small share in rendering the horse such a complete animal as he is ; and as this is the portion of the foot which comes more immediately under the care and manipulative skill of the farrier, its study should be a little more detailed and minute,

perhaps, than that of the internal structures. For convenience and simplicity in description, it has been divided into "wall" or "crust," "sole," "frog," and "coronary frog-band" or "periople." It is most essential that the farrier should understand the structure, nature, relations, and uses of these parts.

The *Wall* of the hoof (Fig. 5, *b*) is that oblique portion which covers the front and sides of the foot, from the coronet to the ground, and is suddenly



FIG. 5.—PROFILE OF A FIVE-YEAR-OLD FRONT HOOF THAT HAD NEVER BEEN SHOD: EXTERNAL FACE. Angle of wall at toe 51° . *a a*, Frog band or periople. *b*, Wall. *c*, Toe, between which and *d* is the "outside" or "inside" toe or "mammilla," and between *e* and *f* the "outside" or "inside" heel.

inflected or bent inwards at the heels, towards the middle of the sole to form the "bars," which are merely prolongations of its extremities (Fig. 8, *f f*). It constitutes the circumference or margin of the hoof; is the part of the horny box that is intended more especially to come into contact with the ground, and is that on which the iron defence, or shoe, rests, and through which the farrier drives the nails that attach it to the hoof. The inner face of its upper edge is

hollowed out into a somewhat wide concavity (cutigeral groove) (Fig. 6, *b*), which receives, or rather in which rests, the coronary cushion. This concavity is chiefly remarkable for being pierced everywhere by countless minute openings—looking as if made by the point of a very fine needle—which penetrate the substance of the wall to some depth; each of these tubes receives

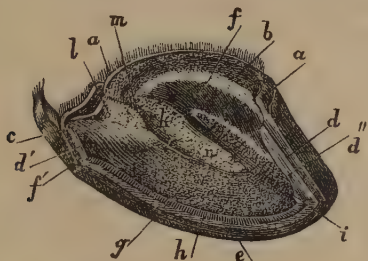


FIG. 6.—THE HOOF, WITH ONE HALF THE WALL REMOVED TO SHOW ITS INTERIOR. *a a*, Frog band. *b*, Cavity for the coronary cushion. *c*, Upper or inner surface of the "bar." *d*, Vertical section of the wall in front. *d'*, Ditto at the heel. *d''*, A horny leaf or lamina. *e*, Horizontal section of the wall at its junction with the sole. *f*, Laminae or leaves of the wall. *f'*, Ditto of the "bars." *g*, Upper surface of the horny sole. *h*, Junction of the horny laminae with the sole at the so-called "white line." *i*, Toe-stay at the middle of the toe. *k*, Upper surface of the horny frog. *l*, Frog-stay. *m*, Cavity corresponding to a branch of the frog. *n*, Ditto, corresponding to the body of the frog.

one of the "villi" or minute tufts of bloodvessels already mentioned as prolonged from the face of the membrane covering the coronary cushion. Below this concavity, which receives a large share of the horse's weight, the wall is of about equal thickness from top to bottom, though it gradually diminishes in thickness from the toe to the heel, and in most

hoofs the wall is thinner at the inside than the outside quarter of the hoof. The average thickness of the wall is nearly $\frac{3}{8}$ inch. On the whole of its inner surface are ranged thin, narrow, vertical horny plates or leaves (horny laminæ) (Fig. 6, *f*), in number corresponding to the sensitive laminæ, between which they are so intimately received or dovetailed—a horny leaf between every two sensitive ones—that in the living or fresh state it is almost impossible to disunite without tearing them. The inner face of the lower margin is united in a solid manner to the margin of the horny sole, through the medium of a narrow band of soft, light-coloured horn, situated between the two, which we may call the “white line” (Fig. 6, *h*).

The outer surface of the wall is generally smooth shining, in the natural healthy state.

The dimensions of the wall vary in different situations; in front it is deepest and thickest, but towards the quarters and heels it diminishes in height and becomes thinner; at its angles of inflection—the points of the heels—it is strong and thick. Its structure to the naked eye appears fibrous; the fibres, which are cylindrical, pass directly parallel to each other, and generally in a straight direction, from the coronet to the ground, each fibre being moulded on, as it is formed by, one of the villi of the coronary band lodged in the cavity within the upper margin of the wall. Microscopically, the wall is composed of minute cells, closely compressed, and arranged *vertically* around each fibre, and *horizontally* between the fibres. These fibres are commonly called tubes, as they are hollow, and partly occupied by the villi of the coronary band, while the

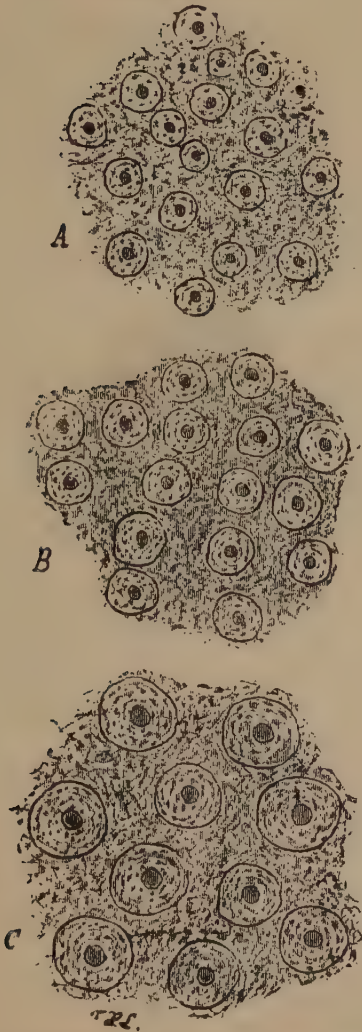


FIG. 7.—TRANSVERSE SECTIONS OF THE WALL, magnified 30 times.
 A, From a newly born foal. B, From a foal between three and four months old. C, From a fully-grown horse. (From Peuch and Lesbre, "Pied du Cheval.")

remainder of their length contains a dark-coloured cellular débris. The tubes are not in immediate contact with one another; a horny tissue (intertubular substance), formed by the intervillous portions of the coronary band, exactly fills the intervals between the tubes or fibres.

A point of much practical interest is to be found in the fact, that the fibres on the surface, or outside of

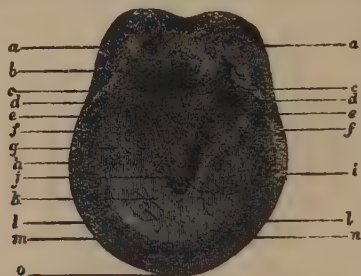


FIG. 8.—PLANTAR SURFACE OF LEFT FORE HOOF OF A FIVE-YEAR-OLD HORSE THAT HAD NEVER BEEN SHOD. *a a*, Glomes or heels of the frog. *b*, Median lacuna or "cleft" of the frog. *c c*, Branches of the frog. *d d*, Heels, "angles of inflexion," or "buttresses" of the wall of the hoof. *e e*, Lateral lacunæ or spaces between the frog and bars. *f f*, Inflexions of the wall or "bars." *g*, Body of the frog. *h*, Outside quarter of the hoof. *i*, Inside quarter of the hoof. *j*, Point of the frog. *k*, Sole. *l l*, Commissure, "white line," or line of junction between sole and wall. *m n*, Mammilla. *o*, Toe.

the wall, are very close and hard (Fig. 6, *d*): so dense, indeed, that the wall of an un mutilated hoof looks like whalebone; but towards the inner surface, they become softer, lighter-coloured, more spongy, and easily cut (Fig. 6, *k*).

The *Horny Sole* (Fig. 8, *k*) is contained within the

lower margin of the wall, and is a concave plate covering the lower face of the pedal bone. It has essentially the same structure as the wall, the fibres passing in the same direction from above to below. The horny sole, consisting of horn tubes and intertubular substance, is formed in the same manner as the wall, by the papillæ and interpapillary portions of the sensitive membrane which immediately covers the sole of the bone. These villi penetrate the horn-tubes to some depth, as in the wall, and not only form them, but maintain them in a supple condition.

The sole is thickest around its outer border, where it joins the wall; thinnest in the centre, where it is most concave. A notable peculiarity in this part of the hoof, and one which distinguishes it from the wall, is its tendency to break off in flakes on the ground face when the fibres have attained a certain length; the wall, on the contrary, continues to grow downwards to an indefinite extent, and unless kept within reasonable dimensions by continual wear or by the farrier, would in time acquire extraordinary length and distortion. The horn of the sole, for this reason, is less dense and resisting than that of the wall, and is designed more to support weight than to sustain wear.

The "*Horny Frog*" (Fig. 8, *a*, *c*, *g*, *j*) is a mass of flexible horn, applied and moulded on the plantar cushion or "fatty frog." It is triangular, or rather pyramidal in shape, and is situated at the back part of the hoof, within the bars; with its point or apex (*j*) extending forward to the centre of the sole, and its base or thickest portion filling up the wide space left between

the inflexions of the wall. In the middle of the posterior part is a cleft, which, in a healthy state, should not be deep, but rather shallow and sound on its surface (b). The walls of this cleft are pierced by the excretory canals of the sudoriparous glands of the plantar cushion.

In structure, the frog is rather different from that of the sole or wall, and it closely resembles that of



FIG. 9.—FROG AND PERIOPLE (after Duhousset). *k l*, Point of frog. *o o*, Glomes of frog. *i i*, Branches of frog. *p*, Periople. *h*, Cleft of frog. (From Peuch and Lesbre, "Pied du Cheval.")

the periople. The tubes pass in the same direction as those of the sole; but instead of being like them, quite rectilinear, they are slightly flexuous in their course, and present some microscopical peculiarities which, though interesting to the comparative anatomist, need not be alluded to here. The horn-tubes of the frog are finer and more closely packed together than

those of the sole or wall, and they are formed by the villi which thickly stud the face of the membrane covering the plantar cushion or sensitive frog.

The substance of the horny frog is eminently elastic, and corresponds in the closest manner to the dense, elastic, epidermic pads on the soles of the feet of such animals as the camel, elephant, lion, bear, dog, and cat. These pads are evidently designed for contact with the ground, the support and protection of the tendons that flex the foot, to facilitate the springy movements of these creatures, and for the prevention of jar and injury to the limbs. The frog of the horse, when in constant contact with the ground, is very hard and resisting on its lower surface, and as secure from injury from stones as any other part of the lower face of the hoof.

The presence of this thick, compressible, and supple mass of horn at the back of the hoof is absolutely essential to the well-being of the horse's foot; and more especially if speed, in addition to weight-carrying, be demanded from the animal.

The frog, like the sole, exfoliates, or becomes reduced in thickness at a certain stage of its growth; the flakes are more cohesive than those of the sole, and frequently a piece corresponding to the whole surface of the organ becomes detached.

It must be remarked, however, that this exfoliation of the sole and frog only takes place when the more recently formed horn beneath has acquired sufficient hardness and density to sustain contact with the ground, and successfully to bear exposure to the effects of heat or dryness, and moisture.

The "*Coronary Frog-Band*," or "*Periople*" (Figs. 5, a, 6, a) is a continuation of the epidermic or more superficial layer of the skin around the coronet and heels, in the form of a thin, light-coloured band that descends to a variable depth on the outer surface of the wall, and at the back part of the hoof becomes consolidated with the frog, with which it is almost identical in structure and texture. It can be readily

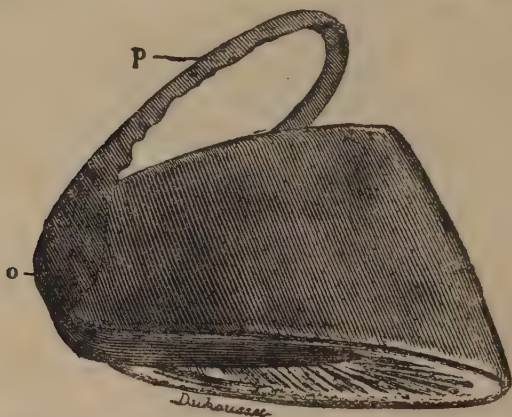


FIG. 10.—SHOWING HOOF WITH FROG BAND RAISED (after Duhousset). *op*, Periople or frog band. (From Peuch and Lesbre, "*Pied du Cheval*.")

perceived in the foot that has not been dressed by the farrier's rasp, extending from the coronet, where the hair ceases, to some distance down the hoof; it is thickest at the commencement of the wall, and gradually thins away into a fine film as it approaches the lower circumference of this part. Towards the heels it is broadest and thickest. When wet it swells and softens, and on being dried shrinks—sometimes

cracks—in its more dependent parts, or becomes scaly.

The tubes composing it are very fine and wavy, as in the frog; they grow from the villi which stud the perioplic ring or membrane immediately above the “coronary cushion.”

The use of this band would appear to be two-fold: it connects the skin with the hoof, and thus makes the union of these two dissimilar textures more complete, its intermediate degree of density and its great elasticity admirably fitting it for this office; and it acts as a covering or protection to the wall at its upper part, where this is only in process of formation, and has not sufficient resistance to withstand the effects of exposure to friction or the weather. The greatest thickness and firmness of the band corresponds to the portion of the wall in which the villi or vascular tufts are lodged, and here the horn is soft, delicate, and readily acted upon in an injurious manner by external influences.

Thus far, then, we have rapidly glanced at the anatomy and uses of the various parts entering into the composition of the horse's foot, and its horny box—the hoof. It may be necessary, before passing to the consideration of the latter as a whole, to allude to the structure and uses of that narrow strip of horn, the “white line,” whose presence every farrier or veterinary surgeon is cognizant of, but whose character and functions have been strangely left out of consideration by all anatomists hitherto. It is a slender intermediate band that runs around the margin of the sole, and connects that plate of horn so closely to the

wall as to make their union particularly solid and complete (Figs. 6, *h*, 8, *l*). When preparing the border of the hoof for the reception of the shoe, this part is easily distinguished by its lighter colour (in a dark hoof), and by its being softer and more elastic than either the sole or wall, between which it is situated. It would appear to be formed by the villi which terminate the lower end of the vascular laminæ, and the horny leaves of the wall are also received into its substance—a circumstance that renders the junction of the two more intimate and secure. There can be no doubt that the principal use of this elastic rim of horn, placed in such a situation, is to obviate the danger of fracture to which the inferior part of the hoof—particularly the sole—would be liable, if the junction between the hard and comparatively inelastic sole and wall was directly effected without the interposition of such a body.

It may be noted, that it is through this soft border of horn that gravel and infective matters usually find their way to the sensitive parts of the foot, and there excite not only irritation, but frequently lead to the formation of pus, and cause much pain and lameness; a condition which the older farriers termed “graveling.”

In viewing the horse's hoof as a whole, and in the unshod state, it will be found to present several salient characteristics, the consideration of which ought to dominate or serve as a guide in framing rules for farriers in the practice of their art. The first of these is the direction in which the wall grows when it is in a healthy condition.

Viewed as it stands on a level surface, the hoof may be said to be somewhat conical in shape, its upper part being a little less than its base; and although, geometrically, its shape may be described as the frustum of a cone, the base and summit of which have been cut by two oblique planes—the inferior converging abruptly behind towards the superior—yet the circumference of the hoof does not offer that regularity which this description might imply; on the contrary, in a well-formed foot, we find that the outline of its inferior, or ground border, is notably more salient on the outer than the inner side, giving it that appearance which has been designated the “spread.”

A cone intersected by two planes oblique to its axis, and not parallel to each other, gives a good idea, nevertheless, of the obliquity which forms so marked a feature of the hoof. The degree of obliquity of the front part or “toe,” and of the upper surface, varies with the amount of growth; but where this has been counterbalanced by a proper degree of wear, it will be remarked that this obliquity corresponds to the inclination of the pastern bones immediately above the hoof, when the horse is standing.

It will be obvious that this inclination also varies with the breeding of the animal, and the conformation of the limbs; so that no definite degree can be assigned. But it must be pointed out, that giving the angle of 45° , as is done in almost every treatise on shoeing and the anatomy of the foot, is a grave error. Looked at in profile, a hoof with this degree of obliquity would at once be pronounced a deformity—the slope is too great (Fig. 11); and if the farrier were to attempt to

bring every foot he shod to this standard, he would inflict serious injury, not only on the foot itself, but also on the back tendons and the joints of the limbs. Careful measurement will prove that the obliquity of the front of the hoof is rarely, if ever, in a well-shaped leg and foot, above 50° , and that it is, in the great majority of cases, nearer 56° . The sides or "quarters" of the wall are less inclined—though the outer is generally more so than the inner; while the heels are still more vertical, and the inner may even incline slightly inwards. Viewed in profile, the posterior face

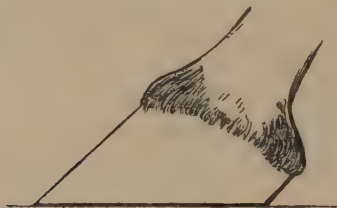


FIG. 11.—SIDE VIEW OF A HOOF WHICH IS TOO OBLIQUE.

of the hoof will be observed to have the same degree of slope as the front face. In height, the heels are usually a little more than one-half that of the toe; both heels are, or should be, equal in height.

These features, as will be seen hereafter, are of sufficient consequence to be constantly remembered. The other characteristics are to be found on the lower or ground face of the hoof—the most important, so far as the farrier's art is concerned.

In a natural condition, the whole, or nearly the whole of this face comes into contact with the ground, each part participating more or less in sustaining the weight

thrown upon the limb. On soft or uneven ground, the entire lower border of the wall, and the sole, bars and frog, are subjected to contact; nature intended them to meet the ground, and there to sustain the animal's weight, as well as the force of his impelling powers. But on hard or rocky ground with a level surface, only the dense tough crust and bars, the thick portion of the sole surrounded by them, and the elastic retentive frog meet the force of the weight and movement; and in both cases, not only with impunity, but with advantage to the interior of the foot, as well as the whole limb. The horn on this face is, as has been said, dense, tough, and springy to a degree varying with the parts of which it is composed; while its fibres are not only admirably disposed to support weight, secure a firm grasp of the ground, and aid the movements of the limbs, but are also an excellent medium for modifying concussion or jar to the sensitive and vascular structures in their vicinity.

The whole circumference of the wall meets the ground, and from the disposition of its fibres, the arrangement of the cells which enter into their composition, and its rigidity, it is admirably fitted to resist wear and sustain weight. It projects more or less beyond the level of the sole, and the space measured between the white zone within it, and its outer surface, gives its exact thickness. This is a fact not without interest to the farrier in the operation of attaching the shoe by nails, as these have to be driven only through this dense horn—which in good hoofs cannot be said to much exceed three-eighths of an inch in thickness—and in proportion to its thinness is the

necessity for carefulness and address on his part, in order to guard against wounding or bruising the sensitive textures.

The sole is more or less concave from its junction with the wall; nevertheless, even on moderately firm ground, a portion of its circumference—which is generally the thickness of the wall—takes a share in relieving the latter of pressure. This is also a fact to be borne in mind. In soft ground, the whole of the lower surface of the sole is made to aid in sustaining the weight, and to prevent the foot sinking. But it must be noted that the pressure of the lower face of the pedal bone or hoof bone on the upper surface of the sole can never be very great, or the sensitive membrane between them would be seriously injured. This injury is prevented by the coronary and, to a less extent, by the plantar cushions, which largely retard the descent of the bone on the floor of the horny box.

The frog, on both hard and soft ground, is an essential portion of the weight-bearing surface. In the unshod, healthy foot it always projects beyond the level of the sole, and seldom below that of the wall at the heels; indeed, it is found, in the majority of hoofs, either on a level with the circumference of this part, or standing above it, so that its contact with the ground is assured. Hence its utility in obviating concussion, supporting the tendons, and, on slippery ground, in preventing falls. In pulling up a horse sharply in the gallop, or in descending a steep hill, the frog, with the angular recess formed by the bar and wall at each side of the heel of the hoof,

is eminently serviceable in checking the tendency to slip; the animal instinctively and forcibly plants the posterior portions of the foot on the ground.

Dark hoofs are generally preferred; they owe their colour to the presence of minute particles of black pigment, which contains a notable proportion of iron. They are considered more resisting to wear than light-coloured hoofs.

A good hoof should have the wall unbroken, its outer face smooth and even, and the angle at the front not less than 50° ; the lower or ground face of the front hoof should be nearly circular in outline—the sole slightly concave at the circumference, deeper at the centre; the border of the wall ought to be thick at the toe, gradually thinning towards the heels, but at the inflexion or commencement of the bar a strong mass of horn should be found; the bars should be free from fracture, and the frog moderately developed, firm and solid, the middle lacuna or cleft being rather shallow than deep, and showing no trace of softness, moisture, or discharge.

The hind foot should possess the same soundness of horn, though it differs from the fore hoof in being more oval in outline from the toe to the heels; the sole is also more concave, the frog smaller, and the heels not so high. The horn is usually less hard and resisting—a circumstance perhaps due to the hind feet being more frequently exposed than the fore hoofs to moisture in the stable.

GROWTH OF THE HOOF

In any treatise on shoeing, the *growth* of the hoof cannot be disregarded ; as on it the foot, in an unshod condition, depends for an efficient protection, while without this process of renewal the farrier's art would quickly be of no avail.



FIG. 12.—THE HOOF OF A FŒTUS, six months old, anterior surface.



FIG. 13.—THE HOOF OF A FŒTUS, six months old, posterior surface. *P P*, Wall. *S*, Sole. *F F*, Branches of frog.

(From Peuch and Lesbre, "Pied du Cheval.")

In its unshod state, the hoof being exposed to continual wear on its lower surface, from contact with the ground on which the animal stands or moves, is unceasingly reproduced by the horn-forming tissues within. We have already referred to the special

apparatus which is more immediately concerned in this work of regeneration, and pointed out that the wall, with the laminæ on its inner face, is formed from the coronary cushion at the upper part of the foot; the sole from the membrane covering the lower face of the pedal bone; and the frog from that which invests the plantar cushion. It has been also mentioned that this horny envelope, instead of being merely in juxtaposition or simple contact with this sensitive secretory membrane, is everywhere penetrated to a certain depth on its inner face (with the exception of the portion of the wall covered with the horny leaves) by multitudes of minute processes named "villi," which are not only concerned in the growth of the horn-fibres—acting as moulds for them, and endowing the hoof with that degree of lightness, elasticity, and toughness which is so necessary to its efficiency—but also make this insensitive case a most useful organ of touch.

The growth of the horn takes place by the deposition of new material from the secreting surface; this deposition is effected at the commencement or inlet of the tubes, on the inner face of the hoof; there the horn is yet soft, and its incessant reproduction causes these hollow fibres to be mechanically extended, or pushed downwards towards the ground in a mass. Once formed, the fibres are submitted to no other change than that of becoming denser, harder, less elastic, and drier, as they recede farther from the surface from which they originated.

So regular is this growth, generally, in every part of the hoof, that it would appear that the secreting

membrane is endowed with an equal activity throughout.

But though this equality in the amount of horn secreted over so wide a surface is an undoubted fact, yet it must not be forgotten that, under the influence

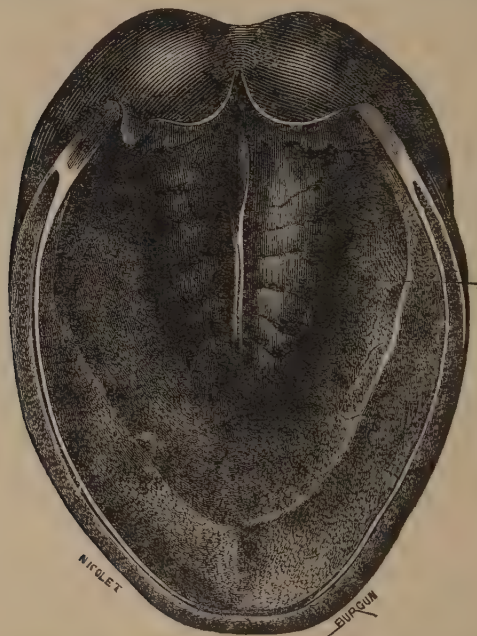


FIG. 14.—INFERIOR SURFACE OF THE HOOF OF A YOUNG FOAL (after Bouley). (From Peuch and Lesbre, "Pied du Cheval.")

of certain conditions, the growth or descent of the horny material may be effected in an irregular manner, either through a particular portion of the secretory apparatus assuming a more energetic activity, or from its being impaired more or less in function.

For instance, the way in which the foot is placed on the ground has a marked influence, not only on the amount of horn secreted, but also on that subjected to wear.

When the superincumbent weight of the body and limb is equally distributed over the lower face of the hoof, the foot may be said to be properly placed as a basis of support to the whole. But when, through mismanagement or defective form, this base is uneven—one side higher than the other, for example—the weight must fall on the lowest part to a greater degree than the highest; thus causing not only disturbance in the direction of the limb and its movements, but considerably modifying the growth of the horn. This growth is diminished at the part subject to most pressure, while on the side which is subjected to the least compression, the formation of horn is augmented. This is a fact of much importance and practical interest in farriery, as it demonstrates that any irregularity in the distribution of the weight of the body on the foot has a prejudicial effect on the secreting apparatus of the organ, and, as a result, on the form of the hoof.

When the weight is evenly imposed on the foot, this apparatus, being uniformly compressed throughout its extent, forms horn equally at every point.

It is the same with the *wear* of the hoof. A just disposition of the weight is a necessary condition of the regularity of wear. While the animal is standing on unshod hoofs, the wear of horn is slight; it is in movement that it becomes increased, and this increase is generally in proportion to the speed, the weight carried, the nature of the ground, and whether its

surface be wet or dry. Each portion of the lower face of the hoof—wall, sole, bars, and frog—should take its share of wear and strain ; but it will be readily understood that this cannot be properly effected if the weight is thrown more upon one side than the other ; that part which receives the largest share will be subjected to the greatest amount of loss from wear, and this, with the diminished secretion of horn, will tend to distort foot and limb.

In a well-formed leg and foot, the degrees of resistance of the different parts of the hoof are so well apportioned to the amount of wear to be sustained, that all are equally reduced by contact with the ground, and the whole is maintained in a perfect condition as regards growth and wear.

The amount of growth, even in a well-proportioned hoof, varies considerably in different animals, according to the activity prevailing in, or the development of, the secreting apparatus ; and in this respect the operations of the farrier, as we will notice hereafter, are not without much influence.

It may be laid down as a rule, that the horn grows more rapidly in warm dry climates, than in cold wet ones ; in healthy energetic animals, than in those which are soft and weakly ; during exercise, than in repose ; in young, than in old animals. Food, labour, and shoeing also add their influence ; while the seasons are to some extent concerned in the growth and shape of the hoof. In winter it widens, becomes softer, and grows but little ; in summer it is condensed, becomes more rigid, concave, and resisting, is exposed to severer wear, and grows more rapidly : this variation

in quality being a provision of nature to enable the hoof to adapt itself to the altered conditions it has to meet—hard horn to hard ground, soft horn to soft ground.

In this way we can account for the influence of locality upon the shape of the foot. On hard dry ground, the hoof is dense and tough, with a concave sole, and a small but firm frog ; while in marshy regions it is large and spreading, the horn is softer and more easily destroyed by wear, the sole is thin and flat, and the frog is an immense spongy mass which is badly fitted to receive pressure from even slightly hardened ground. In a dry climate, we have an animal small, compact, wiry and vigorous, travelling on a surface which demands a tenacious hoof, and not one adapted to prevent sinking ; in the marshy region we have a large, heavy, lymphatic creature, one of whose primary requirements is a wide flat foot to enable it to travel on a soft or yielding surface. Change the respective situations of these two horses, and nature immediately begins to transform them and their feet. The light, excitable, vigorous horse, with its small vertical hoofs and concave soles—so admirably disposed to traverse rocky and slippery surfaces—is physically incompetent to exist on low-lying swamps ; while the unwieldy animal, slow-paced and torpid, with a foot perfectly adapted to such a region—its ground face being so extensive and flat that it sinks but little, and the frog developed to such a degree as to resemble a ploughshare in form, which gives it a grip of the soft slippery ground—is but indifferently suited for travelling on a hard rugged surface. In

process of time, however, the small concave hoof expands and flattens, and the large flat one gradually becomes concentrated, hardened, and hollow; these changes being designed to suit the altered physical conditions in which the animals are placed.

The degree of health possessed by the horn-secreting apparatus at any time has also much to do with its activity in generating new material. When its blood-vessels become congested or contracted, its function is in a proportionate degree suspended, and the hoof grows in an irregular manner, and may be altered in thickness, texture, and quality.

In the ordinary conditions of town work and stable management, the wall of a healthy foot—its chief portion, so far as farriery is concerned—grows down from the coronet at the rate of about three-fourths of an inch per month, and the entire wall of a medium-sized hoof is reproduced in from seven to ten months.

The process of growth can be greatly accelerated by irritating the skin over the surface which throws out the horn material. Thus a blister, hot iron, or any other irritant, or stimulant applied to the coronet, will induce not only a more rapid formation, but one in which increased thickness is a marked though only a temporary feature.

SHOEING

In the foregoing pages, the foot of the horse, in a natural condition, has been considered as perfectly adapted for the performance of its functions: as a basis of support while the animal is standing, and, in

addition, as a powerful propelling instrument during progression.

Further, the hoof which envelops it, like a huge finger-nail, is admirably constructed and endowed as an aid and protection to this organ ; its utility mainly depending on the texture and arrangement of the horny matter of which it is composed, and the peculiar disposition of this in fibres or tubes of variable density, size, and elasticity.

But these qualities of the hoof are intimately dependent upon the manner in which the horn-secreting surface performs its function ; for if this membrane becomes weakened, or unable to supply sufficient material to compensate for undue wear, the protecting case soon ceases to guard the living tissues within from injury.

In the natural unshod state, when the equilibrium between growth and wear is destroyed, and the latter takes place in a rapid and unusual manner, the animal is compelled to rest until the worn hoof has recovered its proper thickness ; for acute pain results when the living parts are exposed, or when the thinned horn is insufficient to guard them against being bruised by the ground.

In an artificial condition, when the horse is employed on hard roads, broken ground, and in a humid climate, to carry and draw heavy loads at different degrees of velocity, and is forced to stand on stone pavements during resting hours, his hoofs are unable to meet the many severe demands imposed upon them. The wear more than counterbalances the growth ; and therefore it becomes an absolute necessity, if the animal is to be continuously and profitably utilized, that an

artificial protection, sufficient to meet the exigencies of the case, be employed.

The lower border of the wall is, as we have mentioned, the part most deeply concerned in resisting wear and strain in the unshod state, as on it the stress chiefly falls ; it is, consequently, the portion of the hoof that suffers most severely from undue wear, and that which alone requires protection.

This fact must have been brought prominently before the primitive shoers of horses thousands of years ago, as the earliest specimens of shoes yet discovered are narrow, and in width do not much exceed the thickness of the wall. To guarantee this from wear was to increase the value of the horse a thousandfold, and the simply wrought, narrow rim of iron, boldly and securely attached to the hoof by a few rudely shaped nails, was sufficient for the purpose.

But having fastened on this light metallic armature, and allowed it to remain fixed to the hoof for a lengthened period, it must soon have been discovered that the balance between growth and wear was again disturbed, but this time in favour of growth ; for the wall being removed from contact with the ground, and the rate of growth continuing as in the unshod state, the hoof, instead of becoming diminished as before, now became abnormally overgrown, and caused inconvenience. Then the shoe required to be taken off, and the superfluous horn either removed by instruments and the shoe replaced ; or the animal was made to travel without the iron defence until it was again needed, perchance when the hoof had become too much worn.

Such was horse-shoeing, in all probability, in early times, and such it is to-day, where utility is not sacrificed to stupid theories or foolish practices.

The evils attending the usual methods of shoeing are, as has been said, very serious and glaring; and the chief of these do not so much depend upon the faulty conformation of the shoe—though this, in many cases, may not be blameless—as upon the treatment the hoof receives before and after the application of that defence.

To illustrate these evils, as well as to indicate how the art of farriery should be practised, we will commence with the foot of the unshod colt, and in the simplest words at our command, describe the ordinary procedure in applying shoes to its hoofs for the first time; pointing out, at each step in the process, what is wrong and what is right, and giving reasons for the adoption of the principles which, in our opinion, ought to guide the farrier in this most important work.

PREPARING THE HOOF

We will assume that the young horse about to have its hoofs armed for the first time is tolerably docile, and that its tranquillity is not likely to be severely disturbed by the unusual sounds, and the strange manipulations to which its limbs are to be subjected. For some time previously, its attendants should have had this ordeal in view, and in handling the colt or filly ought not to have forgotten to manipulate its legs and feet quietly and gently, after the fashion of the

farrier—even going so far in the lessons as to tap lightly on its uplifted hoof, as if nailing on the shoe. The young creature is generally intelligent enough soon to perceive that in this no harm or punishment is intended, and in a short period it becomes familiar with the practice.

The farrier who shoes a young horse for the first or second time, should be a patient, good-tempered man, and an adept in the management of horses and handling their limbs. If the operation is to be performed in a forge, there should be as little noise of hammers or glare of fires as possible—everything ought to be conducted quietly, steadily, and with kindness. Harsh treatment, or unskilful handling, should be severely reprehended, and all restraint or contention ought to be dispensed with—at any rate, until gentleness and patience have been diligently employed and have failed. If accustomed to companions, it ought to have one or two horses beside it in the forge, and someone it knows, and in whom it has confidence, should be present to assist in calming its fears and reassuring it.

In describing the construction of the foot, we referred to the shape of a well-formed hoof. Very probably the animal before us—like nearly every unshod horse—has hoofs of this description.

The first step, usually, in the preparation of this part for the shoe, is to level and shorten the lower margin of the wall, and, erroneously, to pare the sole and frog, and open up the heels. These details may not be carried out so fully in the first shoeing as subsequently, but we will note them as they are commonly practised during the horse's lifetime.

Levelling the Wall is an important operation, which requires to be done properly. It has been stated that unequal pressure on one side of the foot—one side of the wall being lower than the other—is not only injurious to the whole limb by the undue strain it imposes on the joints and ligaments, but that it tends to deform the hoof and modify the growth of the horn.

It is, therefore, most essential that both sides of the hoof be of equal depth, in addition to the whole lower margin of the wall being level; and to make them so, the rasp should be applied to this border in an oblique manner, across the ends of its fibres, to bring them to the same length.

A good idea of the necessary reduction to be effected on either side will be derived from an inspection of the limb from the knee or hock downwards, when the foot is placed firmly and straight upon the ground. Any deviation of the hoof to the inside or outside—most frequently it is the former—can be readily detected by looking at the leg and hoof in front.

The ground surface of the foot should be directly transverse to the direction of the pastern, and it is in maintaining or restoring this relation that care and skill are required. If the pastern is perpendicular to—that is, in a straight line with—the shank bone, and the two sides of the lower margin of the foot are directly transverse to the line passing down from these, then the wall has only to be lowered equally on both sides, if it be too high.

It must be remembered, in levelling both sides of the lower surface of the hoof, that the difference of a few fractions of an inch between them will cause

considerable, and perhaps very hurtful, oscillations of the weight thrown on the limb, and especially at the fetlocks.

A properly instructed farrier should be able, at a glance across the upturned foot, to discover whether it is tolerably level. In Fig. 15, I have shown what is meant by a properly levelled hoof, the dotted line *a a*, across the quarters, being directly transverse to the vertical line *b*, and the distance from *a* to *c* of one side being equal to that from *a* to *c* of the other.

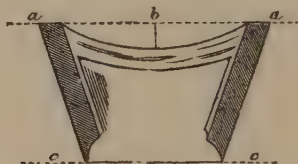


FIG. 15.—PLAN OF A HOOF to show how it should be levelled at each side, in order to preserve the proper direction of the limb and foot.

Shortening the Wall.—Reducing the wall to proper dimensions is another important step in connection with the preparation of the foot for the shoe. We have seen that the natural and moderate wear of the unshod hoof is compensated by the incessant downward growth of the horn, and that this process of wear and regeneration maintains the natural dimensions and just bearing of the foot. But on the application of the shoe a barrier is at once opposed to the wear, while the growth is not interfered with; consequently, the hoof continually increases in length and obliquity—a change which causes derangement in the disposition

of the weight on the lower part of the leg and foot, and other inconveniences.

In speaking of the growth of the horn, it was remarked that in health this took place in a regular manner over the whole surface. It seems rather contradictory, therefore, to assert that the hoof increases in obliquity—appears to grow faster at the toe than the heels—when, if this statement is correct, their increase in length should be always the same. In the unshod hoof this lengthening of the toe is not observed; it only occurs in one that has been shod, and is to be accounted for by the fact that the shoe not being nailed back so far as the heels, is, every time the foot falls on the ground, pressed against the horn at these parts, and so great is this downward friction or pressure, that, after a time, not only is the hoof considerably worn, but the face of the shoe is also polished or channelled at corresponding points. Owing to the shoe being firmly fixed around the toe, there is no play at this part, and hence the apparent inequality in growth between the front and back of the hoof: a circumstance more observable in the fore than the hind foot, from the heels of the former being more under the centre of gravity, and so having a greater weight to sustain.

The pastern and foot form part of a lever that extends from the fetlock to the ground, and supports the weight of the body. The strain comes perpendicularly from the shoulder to the fetlock (Fig. 16, *a*, *c*); but from thence to the ground it passes along the pastern and foot (*c*, *d*)—the extremity of the lever—and these are inclined more or less obliquely forward;

hence the charge imposed on the limb has an incessant tendency to increase this obliquity by bringing the fetlock nearer the ground (*b*). To resist this tendency, however, we have the two flexor tendons, and the powerful suspensory ligament at the back of the limb, which support this joint and maintain its angle.

But it will be readily understood, that the longer and less upright this lever is, the greater is the strain



FIG. 16.—DIAGRAM OF A HORSE'S LIMB from below the knee, to show the direction in which the weight falls upon it.

and fatigue thrown upon the tendons and ligament. Though an oblique pastern may look graceful, and make the horse's step more elastic and agreeable to the rider, yet when the degree of obliquity exceeds that intended by nature, great risk is incurred of injury to the supporting apparatus. Hence the necessity for maintaining the hoof at its normal angle—a necessity, however, which can never be met, except at the moment when the animal is newly shod;

for no sooner is the equilibrium restored between the front and back of the hoof, and the shoe fastened on, than it begins to be disturbed again. This inconvenience is inevitable, from the very nature of the means we adopt to defend the foot from injury.

On the other hand, the suspensory apparatus is less severely taxed, as the lever is short and vertical : or, in other words, as the pastern and hoof are upright. But this, though relieving the tendons and ligament, throws the weight too directly on the bones ; consequently the jar to these and the whole limb is great,

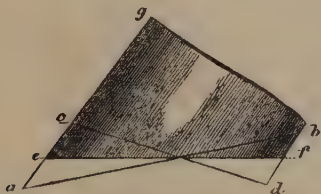


FIG. 17.—DIAGRAM OF THE HOOF to exhibit its relative proportions in length and obliquity.

and even dangerous ; while the back parts of the foot are unduly strained to relieve them.

It must be, then, very evident, that levelling and bringing the ground face of the hoof to the necessary length—equal on both sides from toe to heel, and justly proportioned in depth at toe and heel—is no trifling matter, as the soundness of the limb and ease in progression are concerned in the operation. Excessive length or obliquity of hoof strains back tendons and ligament ; a hoof long at the toe and low at the heels (Fig. 17, *a, b*), increases the obliquity ; on the contrary, when the heels are high and the toe of the hoof too

short (Fig. 17, *c*, *d*), the bones suffer, and the whole limb experiences more or less the effects of concussion.

In both cases progression is fatiguing, defective, and hurtful to an extent proportionate to the excess.

Another disadvantage in shoeing, arising from the tendency of the hoof to increase in length at the toe, and also from its form, is the change in the position of the shoe itself. The hoof being more or less conical in shape, with its base opposed to the ground, it follows that, as it increases in length, its lower circumference also widens in every direction; the result is

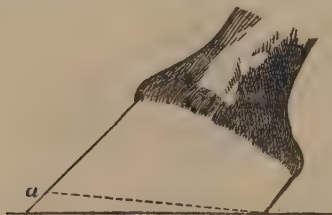


FIG. 18.—A Hoof too oblique reduced to its proper dimensions by the dotted line at *a*.

that the shoe, although at one time accurately fitting the hoof, gradually becomes too narrow; at the same time the increase in length at the toe carries the iron plate forward, away from the heels.

This is another of the inevitable evils of shoeing, but one which, nevertheless, the skilful workman may greatly palliate.

The farrier equalizes both sides of the hoof by applying his rasp in a sloping direction to the ground border or edge of the wall; he also brings it to its natural angle by the same instrument, by removing the neces-

sary amount of horn from the margin of the hoof at the toe or heels : by reducing the former without interfering with the latter, the obliquity of the foot is diminished as in Figs. 17, *c*, *d*, 18, *a* ; while rasping down the heels and leaving the toe untouched increases it (Fig. 17, *a*, *b*).

In the great majority of cases, the heels, for the reason stated, require but little interference ; the excess of growth is nearly always at the toe, and thus

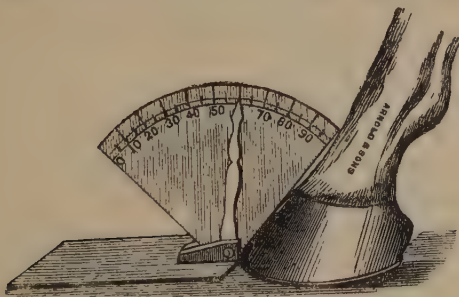


FIG. 19.—INSTRUMENT FOR MEASURING THE DEGREE OF OBLIQUITY OF THE HOOF.*

no absolute rule can be laid down as to the angle to which the hoof should be brought. The practised eye can discern at once whether the angle is in conformity with the natural bearing and direction of the limb, and there will be no difficulty in adjusting it, should it not be so, provided there is sufficient horn to spare for this purpose.

It has been shown that the inclination of the front

* The proportion between foot and instrument is not correct in this drawing. The instrument does not stand higher than the coronet of a large-sized foot,

of the hoof varies from 50° to 60° , and probably the mean between these two angles will be that usually observed. (Fig. 17, *g, e, f*, is a hoof with about 52° of obliquity; *g, a, b*, 45° ; *g, c, d*, more than 60° .)

On ordinary occasions, causing the horse to stand on a level floor, and viewing the hoof in profile a few paces off, is sufficient to inform one of the angles; but to insure accuracy in this matter and prevent mistakes, an instrument (Fig. 19), which at once shows the degree of obliquity, and gives an indication as to the amount of horn to be removed from the toe or heels, should be used.

This instrument being placed on the ground, the straight border of the index plate is placed parallel with the face of the wall, the obliquity of which is then indicated by the vertical pointer on the upper or convex border of the plate, this being marked off in degrees (from 90° to 0°). This instrument will be found very useful in enabling anyone to give directions to farriers as to the proper amount of horn to be removed from the toe and heels at each shoeing. When it is once known what the natural obliquity of the hoof is, the shoer can then be told to preserve that degree at each shoeing, and the indicator will insure this being done with accuracy.

In the operation of levelling and shortening the hoof, is included the general reduction of the wall.

Provided the hoof, before it comes to the hands of the farrier, has the proper inclination and is equal on both sides of its ground face, but is nevertheless overgrown, the workman has then only to remove the excess of growth, without disturbing the relations

between the several regions of the wall. Or should the hoof be overgrown, too oblique, too upright, or unequal at the sides, then in remedying the one defect he at the same time remedies all. The amount of horn to be removed from the margin of the hoof will depend upon circumstances. It may be laid down as a rule, however, that there being but little horn to remove at the heels, these should only be rasped sufficiently to insure the removal of all loose material incapable of supporting the shoe; the quarters or

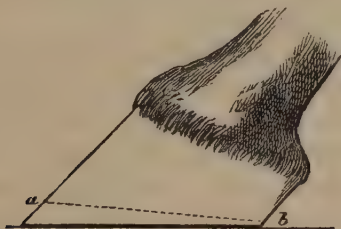


FIG. 20.—DIAGRAM OF THE HORSE'S FOOT, showing, at the dotted line *a b*, the quantity of horn usually required to be removed in the operation of shoeing.

sides of the hoof may require a freer application of the rasp, but as the toe is reached, a larger quantity must be removed, as in Fig. 20, *a, b*. The limit to this removal at the front of the hoof will be when the wall is almost, or quite, reduced to a level with the strong unpared sole. It must ever be borne in mind that, if the wall does not stand beyond the level of the sole, it does not require reducing.

When the circumference of the hoof has at length been brought to a condition fit to receive the shoe, the rasp must finish its task by removing the sharp

edge, and rounding it so as to leave a thick strong border not likely to chip. The unshod hoof nearly always exhibits this provision against fracture of the wall fibres.

Paring the Sole.—After the necessary diminution and correction of the obliquity of the wall, and the preparation of the bed for the shoe, the farrier usually proceeds to pare the sole. Indeed, while the colt is still at large, and before the time has arrived when its hoofs are to be shod with iron, the workman is frequently called in to *trim* the hoofs, and paring the sole is part of the operation.

This procedure is unreasonable, especially when carried to the extent that has been advised in some books on horse-shoeing : viz., to pare the sole until it springs to the pressure of the thumb. Like so many practices relating to the management of the horse, this paring of the sole is absurd in the extreme, and has not the most trifling recommendation to support it. Unfortunately for those who recommend, and also those who practise it, its evil effects are not immediately apparent ; a horse with his soles denuded of their horn until the blood is showing through them, may not at the moment manifest any great suffering, and may even go tolerably sound on a level pavement, though if he chance to put his foot on uneven ground or a sharp stone, his suffering may be so acute as to cause him to stumble or fall.

The paring-knife is skilfully used to remove all the surface horn down to that which has been most recently formed, or is in process of forming. And sometimes so anxious is the groom or farrier to have

this operation thoroughly carried out, that the soles are filled with cow-dung, or other filth, for some time previously, in order that the horn may be softened and rendered more amenable to mutilation. When this "stopping" has not been carried out, and particularly in hot, dry weather, the sole is often so hard that it cannot be touched by the knife, in which case a red-hot iron is applied to the surface to soften the horn. Then the bars and sole are sliced away, until nothing is left but the thinnest pellicle of the natural protection of the very sensitive parts beneath, and not unfrequently the blood may be seen oozing through the horn. To remove the excessive growth of the wall is an absolute necessity; but to denude the sole of its horn is wanton injury to the foot and cruelty to the animal. This is easily accounted for. The sole only increases its substance to a certain thickness—never too much—and then the excess is thrown off in flakes in a natural manner. In this way the sensitive foot within is amply protected; the sole can sustain a share of the weight—especially around its margin in front, where it is strongest—and meet the ground, however rough and stony this may be, with perfect impunity. This is its function.

It has been mentioned that the horn is secreted from the living surface, and that myriads of beautiful vascular and sensitive tufts, dependent from this surface, penetrate the horn tubes to a certain depth, and play an essential part in the formation of the sole. The newly formed horn is soft and spongy, and incapable of resisting much pressure; but as it is pushed further away from this surface by successive deposits

of fresh material, it becomes old horn, loses its moisture, and in doing so acquires the hardness and rigidity necessary to enable it to withstand compression; then it is subjected to wear, and if this fails to reduce it sufficiently, it falls off in scales. But the process of exfoliation is not a rapid one; the flakes remain more or less attached to the solid horn beneath, until it in turn commences to loosen on the surface and yield new flakes, when the old ones entirely separate from it. This natural diminution in the excess of horn of the sole is a most beneficial process for the hoof. Horn is a slow conductor of heat and cold, and when thick, retains moisture for a long period. These flakes, then, act as a natural protective "stopping" to the hoof, by accumulating and retaining moisture beneath; and this moisture not only keeps the foot cool as it slowly evaporates, but insures to the solid and growing horn its toughness, elasticity, and proper development. In addition to this, every flake acts more or less as a spring in warding off bruises or other injuries to the sole; and thus the floor of the horny box is thoroughly protected from injury, externally and internally.

What occurs when the farrier, following the routine of former days or obeying the injunctions of those as ignorant as himself, pares the sole until it springs to the pressure of his thumb? Why, the lower surface of the foot—that which is destined to come into contact with the ground, and to encounter its inequalities and asperities, and which more than any other part requires to be efficiently shielded—is at once ruthlessly denuded of its protection, and exposed to serious

injury. The immature horn, suddenly robbed of its outer covering, immediately begins to experience the evil effects of external influences ; it loses its moisture, dries, hardens, and shrivels up ; it also occupies a smaller space, and in doing so, the sole becomes more concave, drawing after it the wall—for it must be remembered that the sole is a strong stay against shrinkage of the lower margin of the hoof ; and the consequence is, that the foot gradually decreases in size, and the quarters and heels become narrow. The animal goes “tender,” even on smooth ground ; and if he chance to put his weakened sole on a stone, he suffers pain and lameness.

Owing to the secreting apparatus of the sole being deranged through this senseless paring, the formation of new horn takes place slowly, and it is not until a certain quantity has been provided to compensate in some degree for that removed, that the horse begins to travel better. Scarcely, however, has the restorative process advanced to this stage, than it is time for him to be re-shod, when this part must again submit to be robbed of its horn.

The tenderness and lameness arising from this maltreatment are usually ascribed to anything but the right cause, and the most popular is concussion. To avert this and protect the defenceless sole, an absurd shoe is sometimes employed ; and, still more absurd, the natural covering is replaced by a plate of leather interposed between the shoe and the sole, and this is made to retain bundles of tow steeped in tar, or other stopping. It is scarcely necessary to say that this artificial covering is but a poor substitute

for that which has been so foolishly, and with so much careful labour, cut away ; indeed, in several respects the leather, even when only placed between the wall and shoe, and not over the entire surface, is very objectionable.

Seeing, therefore, the natural provision existing in the sole of the hoof for its diminution in thickness, when necessary, and knowing that the intact sole is the best safeguard against injury and deterioration to this region, it must be laid down as a rule in farriery—and a rule from which there must be no departure—that this part is not to be interfered with on any pretence, so long as the foot is in health ; not even the flakes are to be disturbed.

By adhering to this rule, the horse can travel safely and with ease in all weathers, and over any roads, immediately after shoeing ; the foot is maintained in a healthy condition ; the sole can sustain its share of the weight, and thus relieve the wall of the hoof ; and should a shoe happen to be lost, the animal can journey a long distance with but little injury to the foot.

Another of the many advantages derived from allowing the sole to remain in its natural condition, is that on a soft surface the hoof will not sink so deeply as one whose sole has been hollowed out by the farrier ; neither is it so difficult to withdraw from holding ground.

Paring the Frog.—This part of the hoof is that which, in the opinion of a few grooms and coachmen, and others who should know better, most requires *cutting*, “to prevent its coming on the ground and laming the horse ;” and this reason, together with its

softer texture, often causes it to be made the special sport of the farrier's knife. It is artistically and thoroughly trimmed, the fine elastic horn being sliced away, sometimes even to the quick, and in its sadly reduced form it undergoes the same changes as have been observed in the pared sole. No wonder, then, that it cannot bear touching the ground any more than the sole.

The function of the frog in the horse is one of great moment, and has already been indicated. It is eminently adapted for contact with the ground, and in this resides its most important office. To remove it from the ground and deprive it of its horn, is at once to destroy its utility and its structure, and withdraw from the foot one of its most essential components. The longer the frog is left untouched by the knife, and allowed to meet the ground, the more developed it becomes; its horn grows so dense and resisting, yet without losing its special properties, that it withstands the crushing of the roughest roads without suffering in the slightest degree; it insures the hoof retaining its proper shape at the heels; is a valuable supporter of the limb and foot while the animal is standing or moving; and is an active agent, from its shape and texture, in preventing slipping. Its reduction and removal from the ground have a tendency, directly or indirectly, to induce that painful, frequent, and incurable malady—navicular disease, as well as other affections of the foot.

The farrier should, therefore, leave the frog also untouched, unless there be flakes which are useless—though this is extremely rare; then these ought to be

cut off. If any gravel has lodged beneath the flakes, at the side, or in the cleft—which is most unfrequent—this is removed by some blunt instrument.

Opening up the Heels.—This operation is quite as injurious—if it is not more so—as mutilating the other parts; it consists in making a deep cut into the angle of the wall at the heel, where it becomes bent inwards to form the bar. In the unshod, natural state, or in the unmutilated foot, this is a particularly strong portion of the hoof, and serves a very useful purpose, its utility being mainly owing to its strength. From its preventing contraction of the heels, it has been named the *arc boutant*, or “buttress” of the foot by the French veterinarians.

When it is hacked away by the farrier’s knife, the wall of the hoof is not only considerably weakened, but the hoof gradually contracts towards the heels.

The fashion of paring the sole until it yields to the pressure of the thumb has been perpetuated through the ignorance of those who have had the management of horses, or the traditions and routine of the artizans who more especially attend to the requirements of the hoofs of these animals. But it must be observed that this paring, slicing away the frog, and opening up the heels, has been largely due, in later times, to the false notions propounded by some writers regarding the functions of the horse’s foot—such as the descent of the sole, the inability of the frog to sustain contact with the ground, and the expansion of the back parts of the hoof every time the weight is imposed upon it. It is scarcely necessary here to say more, than that these notions are at least extremely exaggerated, and

that the practices which were maintained to facilitate these supposed functions have been productive of an immense amount of animal suffering.

It should ever be most strenuously insisted upon, that the whole lower face of the hoof, except the border of the wall, must be left in a state of nature; the horn of the sole, frog, and bars, has an important duty to fulfil; it is the natural protection to this part of the hoof, and no protection of iron, leather, or other material, is half so efficacious; in addition, it is a capital agent in sustaining weight, and in keeping the whole foot healthy and perfect in form.

THE SHOE

The hoof having been prepared by the farrier, according to his fancy, for the reception of the metal plate which is to garnish it, a suitable shoe is then selected. Here again ignorance may prevail, and may be productive of inconvenience and injury. "Improved principles" may suggest that a particular-shaped shoe be applied: no matter whether the animal be a saddle, harness, or draught horse, it must have a shoe that rests only on the margin of the hoof—on the wall. Therefore, except a narrow border to correspond with this margin, the upper or foot-face of the shoe is seated or bevelled away, so as to leave a wide space between it and the sole, and throw all the weight and strain on the outer parts of the foot (Fig. 21), thus inducing a tendency to deformity and restricted action; in addition to this disadvantage, the space between the sole and shoe is admirably contrived to lodge

stones, gravel, soil, or snow, and in heavy ground it immensely increases the suction. But, as will be easily understood from the manner in which the under-surface of the foot may have been treated, this bevelling is rendered an absolute necessity if the horse is to be preserved from immediate lameness. The sole may have been pared so thin, that so far from its being able to withstand a tolerable amount of pressure around its margin—particularly towards the toe—it must be most carefully preserved not only



FIG. 21.—SECTION OF THE FRONT PART OF THE HORSE'S FOOT and the ordinary shoe, to show the disadvantage of resting the hoof only on the wall.

from contact with the shoe, but also from contact with the ground. This necessitates a wide surface of metal, which increases the weight of the shoe, making it clumsier to wear, and affording a large ground-surface for slipping. And even with a shoe of such dimensions the horse cannot travel at ease on stony roads; as the pressure of a pebble on the tender sole causes him to limp, and if the stone lodges in the space between shoe and sole serious injury may be inflicted.

Weight.—In addition to the bevelling and the width, this shoe has several other glaring defects. One of

these is generally its excessive weight ; it contains an amount of iron far greater than is necessary to protect the hoof from the effects of wear. One reason alleged for the employment of these heavy masses of iron attached to the lower end of the horse's limbs, is that they prevent concussion to the feet. This is a manifest absurdity. The hoof, by its lightness, its texture, and the wonderful arrangement of its component parts, is well adapted to avert concussion ; an inelastic heavy lump of iron firmly attached to it, and coming into forcible contact with the ground at every step, must surely be more likely to increase this concussion than diminish it.

There can be no great difficulty in estimating the injury inflicted by unnecessarily heavy shoes. Nature formed the lower extremity of the limb with a view to lightness, no less than to other important ends. The coffin-bone is quite porous or open in texture, to diminish its weight without detracting from its size or stability ; while the hoof itself is, as we have just noticed, remarkable for the manner in which its material is arranged to confer light-footedness upon the animal. The reason for this diminution in weight, while it is coincident with increase in bulk, is to be found in the fact that the muscles principally concerned in moving the limb—swinging, straightening, and bending it backwards and forwards—are all situated above the knee or hock. The moving power is at one end of a comparatively long lever with two arms, while the weight to be moved is at the other extremity. The arm of the lever to which the power is applied is very short ; so that, though rapidity is

gained, more power is lost. If we therefore consider the anatomy of the limb from a mechanical point of view, it will be obvious that every additional ounce added to the foot must be nearly, if not more than, equal to a pound at the shoulder.

In shoeing, this important consideration is too often overlooked; and yet we cannot forget that it must have a great influence on the wear, not only of the shoe, but also of the muscles, tendons, ligaments, and joints, and even, indirectly, of the entire animal. "If, at the termination of a day's work," says an eminent French veterinary professor, "we calculate the weight represented by the mass of iron in the heavy shoes a horse is condemned to carry at each step, we shall arrive at a formidable array of figures, and in this way be able to estimate the amount of force uselessly expended by the animal in raising the shoes that overload his feet. The calculation I have made possesses an eloquence that dispenses with very long commentaries. Suppose that the weight of a shoe is two pounds, it is not going beyond moderation to admit that a horse trots at the rate of one step every second, or sixty steps a minute. In a minute, then, the limb of a horse whose foot carries two pounds, makes efforts sufficient to raise a weight of one hundred and twenty pounds. For the four limbs this weight in a minute is represented by $120 \times 4 = 480$ pounds; for the four feet during an hour the weight is 28,800 pounds; and for four hours, the mean duration of a day's work in the French omnibuses, the total amount of weight raised has reached the enormous figure of 115,200 pounds. But the movement communicated

to these 115,200 pounds represents an expenditure of the power employed by the motor without any useful result ; and as the motor is a living one, this expenditure of strength represents an exhaustion, or, if you like it better, a degree of fatigue proportioned to the effort necessary for its manifestation."

This question of weight is one of no small moment to the well-being and utility of the horse, and therefore demands particular attention. Nature, in constructing the animal machine, and in enduing it with adequate power to sustain the ordinary requirements of organization, and even to meet certain extraordinary demands, could scarcely have been expected to provide the large additional amount of energy necessary to swing several ounces, or even pounds, attached to the lower extremity of the limb. A horse shod with a two-pound shoe to each foot, travelling at the rate of sixty steps in a minute for a period of four hours, as has been stated above, carries nearly fifty-two tons ; this weight too, as has been stated, is most disadvantageously placed at the end of the long arm of the lever. It must be remembered, also, that a two-pound shoe is a very moderate affair when compared with many that are worn regularly in town and country, even by horses employed in fast work.

Not only does an unnecessarily heavy shoe fatigue and wear out the limbs sooner than a light one, but the lassitude it induces causes it to be less durable, in proportion to the weight of iron it contains. This is accounted for by the manner in which the wearied limbs drag their cumbrous load along the surface of the ground. Heavy shoes also require more, and

larger, nails to attach them securely to the hoof, and this in itself is an evil of no trifling magnitude, as we shall see presently.

The shoe, besides being heavy, may offer other serious defects. It may be very uneven or very narrow on its upper bearing surface—that on which the hoof rests; it may have too many clips, and these not well drawn or situated; its ground surface may be unequal; or the holes for the nails may be badly placed, and improperly stamped.

An uneven or narrow upper surface is apt to produce lameness, from the undue pressure it occasions on limited parts of the hoof, and through these to the corresponding living textures; or it may cause the wall of the hoof to split, etc.

Nails badly placed and holes improperly punched are a prolific source of injury to the foot, and the same may be said of faulty or wrongly situated clips; while much evil results from the ground-face of the shoe being higher at one part than another. This inequality is, in nearly every case, due to the presence of what are termed “calkins” and “wedge heels” at the extremities of the branches of the shoe; or to one side of the plate being thicker than the other.

Calkins.—Calkins are said to be injurious to the limb in proportion to their weight. When smallest they are an evil, as they have a tendency, in raising the back part of the foot higher than the front, to alter the natural direction of the limb, and throw undue strain on the fore part. Intended to prevent slipping, their use in this respect is but temporary, unless they are made high and thick: when their un-

favourable influence on the limb and foot is increased. Added to this, from their throwing so much of the weight and strain on the front of the foot, the shoe is more rapidly worn away at the toe; so its thickness there must be greater, and the shoe in consequence heavier, or the animal will have to be more frequently shod. From their only lasting for a limited period, the horse, at first inclined to rely on them to preserve his footing on slippery roads, becomes timid and unsafe when they are worn down to the surface of the shoe. By their form, and their projecting so much beyond the level of the plate, they jar the limb; expose it to twists and strains, sometimes of a grave character; induce shortening of the flexor tendons; and until they have been considerably reduced, interfere with the animal's tread. They are also liable to cause the shoe to be loosened or torn off, by catching between paving-stones; while they produce severe lacerations, should the horse wearing them happen to kick another animal. This is more particularly observed among army horses which have calkins on their hind shoes—and especially when in camp or picketed. They also throw more strain upon the nails and the hoof itself. Nor must it be forgotten that they remove the frog from contact with the ground.

One side of the shoe being higher than the other produces the same results as follow when the hoof is unequal in this respect. The hind limb is more exposed to this evil than the fore one, from calkins being most frequently added to the outer branch of the hind shoes, and from the fashion of having the inner branch thickened, but not sufficient to equal the height of the

calkin on the outer heel. This inequality is productive of injury to the fetlock and hock-joint, and probably is not unfrequently a contributing cause of "spavin."

But even if the farrier has reason to apply shoes, the ground surface of which is not provided with calkins or any other kind of "catch," he, in nearly every case of ordinary wear, puts on one which has the whole of the surface perfectly plane, and not relieved throughout its length or width by anything, except perhaps the groove (or "fullering") around its outer circumference, in which the nail-holes are placed. Shoes having this wide smooth surface, which is calculated to facilitate slipping on smooth pavements, or even on grass or clay land, are commonly worn by draught horses on the streets of London.

Size.—Besides constructing the shoe of a faulty shape, a common practice is to apply one smaller than the actual outline of the ground surface of the hoof. This is a grave error, and in all probability arises from the desire to make the horse's foot look small and neat, and to produce fine work; just as some makers of shoes for the human foot think it the perfection of fitting to squeeze the foot into a small space. In the horse, however, small shoes are more fruitful of lameness and chronic deformity than even the cramped coverings can be for the human foot, as the horse is compelled to wear his tight plates day and night, while man can relieve himself of his uncomfortable boots for at least some hours of the twenty-four.

The evils of this stupid practice will be referred to later; meantime, it may be sufficient to point out that, in selecting and applying a shoe smaller than the

circumference of the hoof, we are depriving the foot and limb of a portion of their stability and weight-bearing surface. The limb is, in reality, a column of support for the body, and the hoof is the base of this column. This base is very much wider than any other portion, and only commences at the foot, which gradually widens towards the ground, so as to make it still more expanded and efficient. To diminish this base is to frustrate Nature's mode of affording security and ease to the limb, and consequently to impair its stability.

The above are only some of the more prominent evils attendant on certain methods of constructing and shaping the horse's shoes; others, such as making the shoe of inferior iron, and altogether unlike the outline of the hoof, etc., will be glanced at presently.

Objects to be Attained.—We have stated what we imagined were the objects sought to be attained when shoeing was first introduced. To prevent undue wear of the horn, and at the same time to secure a good foothold for the horse, appear to have been all that was considered essential in the infancy of the art of farriery. And it must be conceded that, even now, these are the primary advantages to be achieved in constructing a horse-shoe, no matter what kind of task the horse that wears it may be required to accomplish.

There can scarcely be a doubt that anything more simple and efficient, and at the same time less expensive, than a well-devised iron shoe, cannot at present be produced; nor can the comparatively safe and ready method of attaching it by nails be superseded by any other means that we are acquainted with.

All tentatives in this direction have failed, either because of their inefficiency or greater expense.

Simplicity, cheapness, durability, and perfect adaptability to various requirements, are the essentials to be obtained in horse-shoes ; and if one or more of these is absent in any particular pattern, it can never be generally adopted, and is certain to have but brief success.

The effects of applying an iron defence to the horse's foot, and securing it to the hoof by means of nails, are no doubt a source of injury to that organ, and even with every care a few of these effects are unavoidable ; but they are increased in number and heightened in intensity when the shoe is badly constructed and attached ; whereas, by the exercise of a little common sense and observation, those which cannot be avoided may be greatly mitigated.

The foot, as has been observed, is a perfect organ, formed, in harmony with the other parts of the limb, to meet every requirement in bearing weight and aiding movement.

The hoof, as an integral portion of the foot, possesses these qualities to a high degree, and, but for its inability to withstand incessant wear, would need no assistance from man, except perhaps a little trimming when it became overgrown or irregular. Its lower margin—hard, narrow, and projecting slightly beyond the sole—is well adapted to support weight, withstand wear, and retain a hold of the ground ; the concave sole, in addition to its assisting the margin to support weight and endure wear, also lends its aid in securing a foothold by its hollow surface ; while the angle of the

wall at each heel—the “buttress”—would appear to be specially designed to afford a most effective check to the sliding forward of the foot as the animal suddenly pulls up when moving at a fast pace on level ground, or attempts to stop or diminish his descent on a slippery declivity.

Those who study the functions of the animal body, and who have to restore these when deranged, well know that in their attempts to keep them in a normal condition, or to bring them back to a healthy state, they must attend to the laws which govern these functions, and must follow the indications of Nature. Therefore they may ask themselves if it is possible to construct a shoe which, while cheaply and easily made by any ordinary farrier, will answer the same ends as the lower surface of the foot does in a natural state; at the same time protecting and supporting it, without interfering to any appreciable extent with the healthy functions of the organ. We have seen that the ordinary seated shoe is extremely imperfect, if it is not diametrically opposite to that which we should consider as calculated to protect the foot, secure a good foothold, and interfere but little with its functions. Instead of supporting the sole at its strongest part, and thus relieving the wall from much of the strain, it rests on the wall alone; this is contrary to natural indications. The wide space between sole and shoe affords lodgment to foreign bodies which, when the sole is severely pared, may do grievous harm, and it also increases suction in soft ground; the hoof shows nothing of this kind. Then, again, the ground face of the shoe is a wide and smooth plane which, instead

of preventing slipping, promotes it ; or thickened portions project above this face, and disturb the balance and injure the limb, while they are only of very temporary and questionable service in insuring a firm footing.

In the unshod hoof we see nothing of this, and we are brought to the conclusion, which daily experience amply confirms, that in addition to the management of the hoof being frequently erroneous, the shoe often applied to it is very far from what it ought to be.

Pattern of Shoe recommended.—If the sole of the hoof has not been mutilated by the knife, it does not require to be covered by the shoe, as Nature has furnished an infinitely better protection. Wide-surfaced shoes can therefore be at once dispensed with, and a narrow shoe, made of the very best and toughest iron, adapted for travelling on slippery roads, capable of aiding foot and limb, and sufficient to withstand wear for about four weeks, is all that is required. We will therefore conclude that the upper or foot surface should be the whole width of the shoe, and that it should be plane—not seated ; for we have seen that the sole was destined, particularly at its junction with the wall in front, to sustain weight. We also know that it is advantageous to the whole foot and limb to allow the sole as wide and general a bearing as possible ; so that one part may relieve the other—the sole coming to the aid of the wall, and the frog interposing to share the fatigue imposed upon both, as well as to relieve the strain on the hinder parts of the foot, flexor tendons and limb, and keep a firm grasp of the ground by its elastic and adhesive properties.

The shoe applied to the foot, then, should have its hoof surface flat, in order that it may sustain the wall and as much of this strong portion of the sole as its width permits. This is contrary to the practice, which only allows the wall to rest on a narrow surface, and bevels off the remainder of the shoe to prevent contact with the sole. Many years' experience of this *plane foot-surfaced* shoe in various regions of the globe, and on feet of every kind and quality, have proved the soundness of this view. The foot is brought as near to a state of nature when the greater part of its plantar surface supports the weight of the body, as man can hope to achieve while submitting the horse to an artificial existence.

A light thin shoe is always preferable to a heavy thick one; as the narrowness of the metal insures a good foothold—in this respect imitating the wall; while its thinness brings the sole, frog, and bars in closer approximation to the ground.

It is impossible to devise a shoe that will successfully meet every requirement. The heavy draught horse, doomed to bring into play every muscle in endeavouring to move and draw an enormous load, must have his feet differently armed to the hunter or race horse, with which speed is the chief requisite. Taking into account the different character of the horny textures, it is none the less true, however, that the same rule holds good in all with regard to the sole and frog sustaining weight, though in the slow-moving animal it is of less importance, perhaps, than in the lighter and faster one. The massive draught horse working on stone-paved streets requires toe and heel projections

or “catches” on the ground surface of the shoes, to economize his locomotive powers and to aid his powerful efforts; though his hoofs none the less require the observance of those conservative principles which have been so strongly insisted upon, but which are so seldom applied.

In London, the shoes for draught horses are differently constructed, because the roadways are generally smooth. Their ground surface is either quite flat and



FIG. 22.—FOOT OF A DRAUGHT HORSE SHOD WITH TOE-AND-HEEL-CATCH SHOE.

smooth, or the ends of the branches are merely thickened or “wedged.” The foothold seems insecure, and, in starting or drawing heavy loads, the animal receives little assistance from its shoes, though it must be confessed that London draught horses shod with plain or level shoes in front, and with calkins or wedgeheels on the hind shoes, work quite satisfactorily.

In the cities of the north of England—as in Manchester and Liverpool—heavy draught horses generally

are shod—fore and hind—with shoes bearing toe-pieces and calkins, which appear to be advantageous for animals drawing loads on streets paved with granite setts.

It must be remembered that calkins are chiefly useful when the horse is “backing” a load; the toe, and particularly that of the hind foot, is the part on which the animal relies to start and carry the waggon forward. Therefore, in addition to the calkins or heel-projections, there should be a toe-piece of the same height as the latter, extending across the ground surface of the front part of the shoe (Fig. 22). This addition to the shoe need not increase its weight; indeed, it should enable the farrier to dispense to some extent with the great clumsy masses of iron now in use.

To give the greatest amount of strength and foothold to the shoes of the heavy draught horse, with the least amount of weight, should, therefore, be an object always kept in view in making them. But, with this animal, another principal object is the preservation of the wall of the hoof, in order that it may remain sound and strong for the retention of the nails; to assist in effecting this, the sole and frog must be preserved intact.

The form of the shoe in all cases should, in outline, resemble the shape of the ground surface of the hoof. It has been decided that its upper surface must be flat from the outer to the inner margin. For horses other than those of heavy draught, its width will of course vary; but it is an advantage to have it as narrow as is compatible, in relation to its thickness, with the amount of wear required from it.

The ground face of the shoe for other than draught horses is the next point for consideration. This should always be, if possible, parallel with its upper face : that is, the shoe ought to be plane on both surfaces, and of the same thickness on both sides, not only in the fore, but also in the hind shoes. This guarantees the foot and limb being kept in a natural position. "Calkins" alone on one or both heels are very objectionable, for the simple reason that, as has been stated, they raise the back part of the foot higher than the front, and throw the limb forward ; unless the hoof meets the ground in its natural direction, some portion of the leg or foot will be certain to suffer. Therefore whatever device may be employed to prevent slipping and secure a hold of the ground, should not interfere with the natural direction of the limb or foot. If calkins are deemed necessary, then the front part of the shoe ought to be raised to a corresponding height, either by thickening its substance, or by adding a toe-piece. In the majority of cases, however, the benefit derived from these projections is problematical ; and it is certain that hundreds of horses travel as safely without them as with them. In London they are only used on the hind shoes, and in many large towns they are but little employed, and with advantage to the legs and feet.

In attempting to prevent slipping, and to afford a firm hold of the ground, without having recourse to calkins, a great object is to diminish the wide surface of metal of the shoe, interfering as little as possible with its resistance to wear. The simplest method of doing this is merely to change the bevel on the foot

surface of the seated shoe to its ground surface—making what is now concave, flat, and what is now the flat slippery ground surface, concave. The effect is almost magical in the security it gives the animal during progression, and is best exemplified in the case of the hunter, which is usually shod with shoes of this description. Here again we are only imitating Nature by copying the concavity of the sole. There can be no doubt whatever as to the advantages to be gained by using such shoes. The sole is well sup-



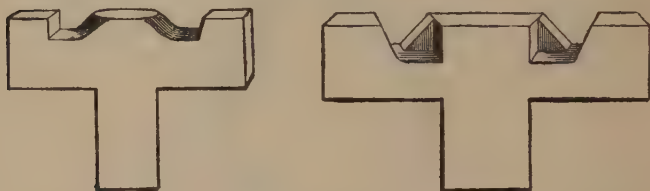
FIG. 23.—GROUND SURFACE OF THE MODIFIED SHOE, showing the bevel and catches.

ported, as well as the whole of the wall, by the wider surface of metal above, while the narrow surface towards the ground affords security of tread.

For general purposes, this is an excellent form of shoe; but to make it still more efficient, it has been modified to represent as far as possible a reproduction in iron of the ground surface of this part of the hoof; it has been employed on the road and in the field with most satisfactory results, both on the fore and hind feet.

In this shoe (Fig. 23), instead of the bevel on the ground surface gradually becoming shallower as it

approaches the heels, as in the ordinary hunting shoe, it becomes deeper until within an inch or two of the extremity of the branch, where it has cut down through the thickness of the inner border; it then abruptly ceases, leaving a sharp catch on each side that, like the inflexion of the wall at this part (Fig. 8, *d d*), affords an excellent grip, which moreover lasts until the shoe is quite worn out. With a modification of this kind, three important objects are secured : 1. The plane upper surface, resting flat and solidly on the crust and unpared sole, leaves no space in which



FIGS. 24 AND 25.—MOULDS FOR THE FABRICATION OF THE MODIFIED SHOE.

foreign bodies—as clay, stones, or gravel—may lodge, and in heavy ground suction is lessened. 2. The metal is only removed from the parts where it can be best spared, and where there is least wear; consequently the shoe is lightened without being weakened. 3. The level border and extremities of the branches afford an equal bearing for the foot, while the gradually deepening bevel, with its sudden check, secures a permanent and powerful catching-point, like that at the angle of the wall.

The shoe is easily made by any farrier, differing, as it does, so little from the ordinary hunting shoe, and

the shape is the same for the fore as the hind shoe, except that the former is, of course, more circular than the latter, to correspond with the shape of the hoof.

To render its formation as simple, speedy, and easy as the ordinary shoe, it may be made in two moulds or "cresses," which fit into the anvil. These moulds are of iron faced with steel; one (Fig. 24) has two wide, slightly curved transverse grooves cut on its surface, one side of each being shallower than the other; in these each branch of the shoe is moulded. The other cress (Fig. 25) has also two indentations so formed as to cut the check or "sunk calkin." With these moulds, the shoe is as easily and quickly made as the common one, and requires but little finishing. The moulds may be of three sizes, to suit different sized feet and different kinds of work, and can be forged by the blacksmith or farrier.

This shoe has been somewhat extensively tried on carriage and saddle horses, and with the very best results. For hunting or cavalry purposes it is excellent, particularly on slippery grass-land, the sharp point of the catch biting the surface of the ground most effectively.

Clips.—For carriage and saddle horses and hunters, each fore and hind shoe should have a clip drawn up at the middle of the toe, except in special cases, as when the horse over-reaches, or from being required to jump or any other cause, is likely to strike any part of the back of the fore legs; in which case the hind shoes require to have a clip at each side of the toe—none in the middle—the hoof in front being allowed to project beyond the shoe; and the latter should have

all sharp edges carefully removed at this part, particularly in the case of hunters.

Clips, when properly drawn and placed, are of service in retaining the shoe, and so permit the number of nails to be diminished ; but, as a rule, they should be as few as possible, as they are sometimes a source of injury to the hoof, particularly if they are situated in too close proximity to the nails.

Varieties of Shoes.—Various forms of shoes have been from time to time proposed with a view to prevent slipping, but only those which have had their ground surface grooved, bevelled, or “toothed” have met with any success. An American shoe, the “Good-enough,” has had wonderful advantages claimed for it in this respect. It differs but little from the common hunting shoe ; it has several projections cut on the outer margin of its lower surface, which may prevent slipping so long as they last, but in a very short time they are worn smooth, and then this shoe has nothing to recommend it beyond the ordinary shoe for hunting horses. The shoe is made by machinery, and is suitable for cold fitting.

Machine-made shoes faced with steel, and grooved into two or more sharp ridges on their ground surface, have also been employed. When fitted, these shoes are tempered ; consequently they are harder than iron, usually wear for a longer period, and are made lighter. Their hardness may cause them to be more slippery than the iron shoe on smooth pavement when their ridges have become somewhat worn, but they are an improvement, and somewhat cheaper than those commonly in use.

Grooved and surface-cut rolled iron bars for the manufacture of horse-shoes are now obtainable.

Machine-made horse-shoes have, unfortunately, never proved entirely successful, owing to the material of which they are often manufactured proving either too soft—when they are too rapidly worn out—or too hard, when they have a tendency either to break or induce slipping.

We have remarked how important it is that the shoes worn by horses should be as light as possible. It is generally a good plan, if a horse wears his shoes more at one part than another, so that they do not last a sufficient time, to weld on a small piece of steel at that place, instead of thickening the shoe, and making it heavier. The latter method, which is that generally adopted to save time, most frequently defeats its purpose—the increased weight causing the animal to drag its feet heavily along the ground, instead of lifting them freely. Lightness and durability can only be attained by employing the best material.

Nail-holes.—The form of the shoe having been decided upon, the position and shape of the nail-holes, as well as their number, have next to be considered.

The shoe ought to be attached by nails to those parts of the wall where the horn is strongest and toughest. In the fore foot, these parts are in front and along the sides, to the quarters; there the horn becomes narrow and thin, the nails find less support, and are nearer to the living textures; this is more particularly the case towards the heels, and especially the inner one. In the hind foot, the wall is generally

stronger towards the quarters and heels. These facts at once give us an indication as to the best position for the nail-holes. In the fore foot, nails can be driven through the wall around the toe as far as the inside quarter, and a little nearer the heel on the outside. In the hind foot, they may be driven around the toe, and even up to the heels with impunity.

The form of the nail-holes is a matter of secondary importance. The "fullering" or groove, around the border of the fullered shoe, though artistic-looking, is a mistake; it is a waste of labour, and of little, if any, service. What is termed the "stamped shoe," is in every way preferable. The square, or somewhat oval cavity, wide at the top and tapering towards the bottom, gives a secure and solid lodgment to the nail-head, which of course should accurately fit the cavity; it does not weaken the iron, is easily made, can be placed nearer the outer or inner margin of the plate as required, and when filled with the nail-head is as capable of resisting wear as any other part of the shoe. It is usually better to have the nail-holes stamped "coarse" (that is, at some distance from the outer margin of the shoe), at points corresponding to those parts of the hoof where the wall is strongest; and "finer," where the horn is thin and its fibres short.

They should not, as a rule, incline outwards or inwards, but be so perforated that the nail-point can take a strong or weak (thick or thin) hold of the wall, according to circumstances. If the hoof be strong, with plenty of wall at its lower margin, then the holes may be stamped *coarse*, in order to take a short but

solid hold of it, by driving the nails obliquely outwards (as in Fig. 26, *a*).

The number of nail-holes through which nails are to be driven should be as few as possible. Every nail penetrating the wall of the foot, no matter how skillfully it may be placed, may be looked upon as a source of injury to it, by splitting asunder or breaking its fibres. On the form and weight of the shoe, will greatly depend the number of nails required to retain it. For the shoe described as a hunting shoe, which

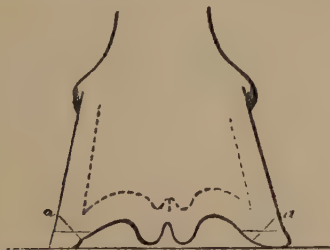


FIG. 26.—DIAGRAM OF THE HOOF AND SHOE, to show the direction the nails should take.

rests firmly on wall and sole, and which is as light as is compatible with the average period of wear, few nails are needed. The seated heavy shoe, on the contrary, is not only damaging to the foot, because it rests on such a narrow basis; but also because its weight and instability necessitate its being attached by a large number of long thick nails, which do great harm to the hoof.

With care in fitting a properly constructed shoe, and skill in placing the nails firmly in sound horn, the usual number may be considerably reduced; so that

instead of seven to ten being required, it will be found that from four to six are equally serviceable, and even these may be of diminished size. For shoes worn by medium-sized draught horses, it is seldom necessary to use more than six nails in the fore and seven in the hind feet; more frequently the former are secured by five nails—three in the outside and two in the inside branch of the shoe, and the latter by three on each side.

The fewer the number of nail-holes, the greater is the necessity for distributing them widely apart; indeed, it is a grave error to cluster the nails closely together in the hoof, as they break and weaken the horn, and attach the shoe much less securely than if they were spread over a larger surface. Calkins demand the employment of additional nails, from their liability to become fixed between stones, and also from the strain they occasion to the pastern.

It must always be remembered, that the retention of a shoe for a sufficient period does not so much depend upon the number of nails attaching it, as upon their disposition, and upon its exact fitting and solid bearing on the wall and sole of the hoof. It should also be borne in mind, that where there is a clip there ought to be no nail; lameness is not unfrequently produced by a tightly adjusted clip pressing unduly upon the nail and horn within it, causing pain by bruising the sensitive foot.

We have alluded to the various patterns of shoes in use, and pointed out their defects and requirements. As, in preparing the hoof, general principles were laid down which are applicable to every kind of animal—

from the race horse to the large draught horse employed in our manufacturing cities—so in the shape of the shoe and its essential characteristics general principles must also prevail. Where speed is demanded, as in the race horse, hunter, etc., lightness and security of foothold on soft or slippery land are the chief *desiderata*; with coach and other draught animals of less speed, which are principally used on paved roads, heavier shoes are needed to sustain wear, and they must also afford security; while, with the hunter and other animals nearly always moving over soft ground, small calkins on the hind shoes may be resorted to without much detriment to the limb and foot, as they sink into the ground, but on the shoes of horses working on hard roads they are objectionable for the reasons stated; if they are employed at all, their injurious effects should be averted by applying a toe-piece of the same height.

For the race horse a narrow steel or iron rim is sufficient, provided it is strong enough not to twist or bend. Shoes of aluminium, and of steel bronze, are also employed, as well as steel tips. The ordinary racing plate is of steel, weighs a trifle under 3 ounces, is $\frac{7}{16}$ inch thick, $\frac{3}{16}$ inch wide, the ground surface is fullered or grooved, and this plate carries eight nails. Another pattern, also of steel, has on its ground face a curling edge, $\frac{1}{4}$ inch deep, which grips the ground in racing. Usually applied to fore feet, it is sometimes used on both fore and hind. It weighs about 660 grains; is $\frac{3}{8}$ inch wide on the foot surface, and nearly $\frac{1}{2}$ inch on the ground face; within the curling edge it is grooved and provided with

nine nail-holes. Shoes of aluminium are used on both fore and hind feet. Each weighs about 780 grains; is $\frac{1}{2}$ inch wide, and $\frac{5}{16}$ inch thick. The ground surface is grooved throughout, the heels are bevelled, and the shoe, which must be fitted close— $\frac{1}{16}$ inch within the crust—to prevent spreading, is secured to the foot with eight nails.

Racing tips of steel are $\frac{3}{16}$ inch thick at the front edge, and $\frac{7}{16}$ inch wide on the foot surface. Each weighs about 780 grains, and is secured to the foot with five nails.

The ordinary training shoe contains a fair proportion of steel, and usually lasts three weeks or longer. It weighs about $6\frac{1}{2}$ ounces, is $\frac{1}{2}$ inch wide at foot surface, and $\frac{5}{16}$ inch thick. The ground surface is grooved, the inner edge “dished” or rounded off, and the shoe is secured to the foot with seven nails. Another working shoe, which gives more cover, is $\frac{3}{16}$ inch thick and $\frac{5}{8}$ inch wide.

For steeplechasing the ordinary training shoe, the plate with curling edge, steel plates with a facing of aluminium, and steel tips are used.

For hunters, hacks, and harness horses, a shoe of the modified pattern already described is well adapted. Hunting fore shoes are usually flat on the foot surface, though sometimes, owing to the sole of the foot being flat, a shoe one-third seated is employed. But seating of any degree is objectionable in a hunting shoe for two reasons: it adds to the effect of suction when the horse gallops over holding ground, and it offers a space for the collection of foreign bodies. The ground surface is concave and grooved, and the heels of this

shoe are short and sloping to prevent catching by the hind foot. The hind shoe is also concave on the ground surface, and it is furnished with a small, square calkin, or a wedge on either heel.

Shoes for hacks are very similar to those used for hunters, but they should be a little heavier to withstand the harder wear.

Harness-horse shoes are always more substantial than those applied to hunters or hacks. A favourite shoe is the "Rodway," which has two grooves and three ridges on its ground surface. Rodway shoes



FIG. 27.



FIG. 28.

may be employed for both fore and hind feet, though frequently the hind feet are shod with ordinary shoes provided with a calkin on the outer and a wedge on the inner heel.

Another excellent form of shoe, introduced by Staff Veterinary Surgeon Thacker, may be mentioned as useful for riding and harness horses. It is broader in the cover at the toe than the heels (Fig. 27); at the toe it is slightly curved upwards, to remove it from the greater amount of wear occurring at this part, and also as a safeguard against stumbling. This curve

likewise acts as a clip to prevent the shoe driving backwards. The foot surface is quite flat, and rests on the sole and wall (Fig. 27). The ground surface (Fig. 28) is bevelled somewhat like the hunting or modified shoe previously described, with the intention of protecting the heads of the nails from too much wear, and offering no line or cavity whereby a stone can lodge or become wedged. The cover or "*web*" of the shoe is gradually brought very narrow at the heels, its outer rim corresponding exactly with the crust, and the ends of the branches terminating at the heels of the foot; thus offering protection to the crust only, and without presenting any surface to be trodden upon, or allowing the least suction in heavy ground.

The nail-holes are in the centre of the *web*, and are directed outwards, by which the nails pass obliquely across the fibres of the wall and secure a good hold, without approaching the sensitive parts too closely. Three-fourths of an inch is supposed to be the height necessary to drive the nails.

There are two small clips—one on each side of the curvature at the toe, and these not only justify the diminished number of nails, but require the farrier to fit the shoe to the circumference of the foot. The smallest-sized nails should be invariably used, and fitted into each nail-hole before applying the shoe. The shoe to be light and made of good material. This pattern, like the modified shoe, is suitable for either fore or hind feet.

It may be mentioned that, with the exception of the two side clips at the toe, this shoe is nearly identical in shape with that recommended by the late Sir Frederick Fitzwygram in his excellent work on Shoeing.

APPLYING THE SHOE

The foot having been duly prepared, and the form of shoe decided upon, the next step is to apply the shoe to the hoof, and retain it there by nails.

Frequently in practice, the wall of the foot has been only partially diminished, the remainder of the task being left until the shoe has to be fitted. This causes the farrier to have a very imperfect idea of the proper shape or size of the hoof, and he therefore prepares a shoe which he guesses is *about* the size, though in nearly every case it is too small; and moulding it according to his fancy, *he proceeds to adjust the foot to it*. This is done by cutting more or less deeply into the wall at the toe, to make the shoe appear long enough by imbedding the clip deeply in its substance, or “letting it back,” as it is termed. The consequence is that, when the shoe has been nailed on, the basis of support of the limb is very much diminished, a large portion of the wall of the hoof—its strongest portion—projects beyond the shoe in front and at the sides, and this is afterwards carefully removed by the rasp, to the great injury of the most essential portion of the hoof. In every respect, the foot is made to fit the shape of the shoe, and as this is generally prepared with a view only to neatness or the traditions of routine, the organ suffers to please the fancy of the unreasoning workman.

By our method, the horn having been reduced to proper dimensions, the shoe is now made to fit the hoof exactly, and to follow the outline of its lower

face. The part of the hoof intended to be protected by the iron rim has been made as level as possible by the rasp, aided a very little, perhaps, by the knife; the surface of the shoe destined to rest on this horny bed has also been made perfectly level and smooth, particularly at the clip or clips, and it is to be correctly fitted. The farrier should so mould the shoe that it will be an exact reproduction in outline of the circumference of the hoof. To cause it to appear so when applied, it may be necessary to remove a little of the wall at the part corresponding to the clip, merely to make the fit more accurate, and not allow any portion of the shoe to project unduly beyond the horn.

The length of the shoe will vary with the services demanded from the horse. For racing, hunting, and other purposes in which the hind limbs are carried forward to an extreme degree in propelling the body, the branches of the fore shoe must on no account extend beyond the inflexion of the wall, otherwise the shoe is liable to be torn off by the hind foot, and the horse thrown down. The end of the branch should also be carefully rounded off and bevelled (as in Fig. 23), so as to leave nothing whatever by which the hind shoe might catch it.

With harness and draught horses, this extreme care in shortening and bevelling the heels is not so necessary; indeed, in the heavier and slower-paced animals, it is frequently advantageous to allow the shoes to be rather longer in the branches than the hoof itself.

As a rule, then, the shoe ought to be wide enough at the toe, quarters, and heels to support the entire thickness of the wall, but yet not so wide or long as

to endanger the opposite limbs by striking them, or run the chance of being torn off by the other feet treading upon it ; and it should not interfere with the frog, nor prevent that organ from playing its part in the functions of the foot.

The adjustment of the shoe to the exact circumference of the hoof, is usually effected at the same time as the fitting together of the two surfaces of iron and horn which are to remain in contact. To render both accurate, the horse should always be shod at a forge. A hammer and anvil are necessary to mould the heated shoe to the requisite shape ; and it is almost, if not quite, impossible to obtain a perfectly true and solid adaptation of the upper face of the shoe to the horn on which it is to rest, within any reasonable time, unless it be fitted to the hoof in a hot state.

Hot and Cold Fitting.—For very many years the two systems of fitting horse-shoes in a cold and a heated condition to the hoofs have been extensively and severely tested, with the result that cold fitting is, as a rule, only resorted to when circumstances prevent the adoption of the other method ; or when the owner of a horse, imagining that the hot shoe injures the foot, incurs the risks attending a bad fit to guard against the supposed evil.

It is needless to enter into a relation of the observations and experiments which have established the undoubted and great superiority of what is termed “hot” to “cold” fitting. These will be found noticed at some length in a work published in 1869.*

* “Horse-Shoes and Horse-Shoeing : their Origin, History, Uses, and Abuses.” London : Chapman and Hall.

It may be sufficient to state, that the evils supposed to result from fitting the shoes hot to the hoofs are purely imaginary. It is true, when the sole has been excessively mutilated, and the farrier keeps the heated shoe too long in contact with the foot, that injury may follow; but this accident is so exceedingly rare as to be scarcely ever known, even in forges where shoeing is performed in an objectionable manner. The ill effects imagined to arise from hot fitting can easily be traced to the operation of other causes, not the least of which is paring the lower face of the foot.

The chief objections to cold shoeing are the absence of solidity, the foot being made to fit the shoe; and the process being more difficult and expensive.

The defective solidity is patent to everyone who has had any experience in the matter. It is impossible to level the ends of the horn fibres so accurately that they will all rest evenly on the surface of the iron; so those which are most prominent soon give way to pressure, the bed of the shoe is altered, and the shoe becoming loose, is either lost, or the clenches project. And even should the fibres be made perfectly level, wet softens them, causing them to become pulpy and shorter, by which means the seat of the shoe is altered and the nails lose their firm hold of the wall. Ample experience on active service, as well as that gathered at home during peace, has demonstrated the instability resulting from cold fitting.

Owing to the increased trouble and loss of time incurred by this method, in attempts to make the shoe fit somewhat accurately, very few farriers can afford or are willing to resort to it. Hence, when it is

practised, if the shoe is at all like the foot, it is put on, and rasp and knife insure the hoof being made to fit the iron. This proceeding is very injurious.

· In hot fitting we have none of these objections. The shoe is very readily adapted to the foot; it is more equally applied, and rests solidly on the hoof, so that the nails are not broken or displaced by the shoe becoming loose; in fine, there is a more intimate contact between the iron and the surface of the horn. The fact of burning or fusing the ends of the horn fibres insures a solid durable bed, which cannot be obtained otherwise; as this destroys the spongy absorbent properties of the horn, and renders it eminently calculated to withstand the influence of moisture. The effects produced on horn by the hot iron have been compared to those of fire on pieces of wood, the ends of which have been superficially carbonized before being buried in the ground. Everyone knows that this operation contributes to the preservation of the wood, by preserving it from the action of humidity.

Horn is a slow conductor of heat, and it requires a very prolonged application of the hot shoe to affect the hoof to any considerable depth. Three minutes' burning of the lower face of the sole has been found necessary to produce any indication of increase of temperature by the thermometer on its upper surface. It is never requisite that the shoe should be applied longer than a few seconds.

The hot shoe, in fusing the horn with which it comes in contact, imprints itself like a seal in melted wax, and in this way the two surfaces of foot and shoe exactly coincide; while no matter how expert the

workman may be in using his tools to level the horn in a cold state, he can never do this so quickly, nor so completely, as may be done by making an impression with the heated iron, and consequently establishing between the lower margin of the hoof and the shoe an exact coaptation.

It may be added, that when the surface of the horn has been softened by the action of heat, the nails enter it more readily, the clips and inequalities are more easily embedded, and when it recovers its habitual consistency after cooling, the union between it and the metallic parts which are in contact becomes all the more intimate because of the slight shrinking that follows the expansion produced by the heat. Under these conditions, the horn contracts on the shanks of the nails, and retains them more securely.

All the most competent veterinary authorities who have studied the subject, are unanimous in recommending hot fitting in preference to cold; the latter is only justifiable when it is impossible to adopt the former. The red-hot shoe at once disposes of those inequalities which cannot be discovered or removed by tools; and it shows the workman at a glance the bearing of the shoe on the hoof, as well as the imprint of the nail-holes. Without being re-heated, any alteration can be readily and at once effected, in moulding the shoe to the shape of the hoof.

The whole surface of the iron intended to be in contact with the horn should be distinctly impressed on the contour of the hoof, so as to insure the closest and most accurate intimacy between the two; and this carbonized surface should not be interfered with

on any account, except by the rasp, which is only to be employed in removing any sharpness or inequality on the extreme edge of the wall, which may have been produced in fitting.

It is necessary to bear in mind that the shoe should be fitted at a *red heat*. Its application then need only be very brief, and it is far more effective in producing a solid level surface; it ought not to be applied at a *black heat*. Should the margin of the hoof not be sufficiently levelled by the rasp before the application of the hot shoe, a slight contact of the latter will show the inequalities, and these may then be removed by rasp or knife. On no occasion ought the shoe to remain longer on the hoof than is necessary to produce a solid and perfectly level surface.

The Nails.—The shoe having been made to fit the hoof exactly, is cooled and finished with the file. It is then ready to be attached to the hoof by nails. These should not be unnecessarily large, as is too often the case, but well proportioned to the size of the shoe. The heads should only be sufficient to fill the nail-holes, when they are subjected to two or three smart blows of the hammer, and the shanks ought to be thin. It is scarcely necessary to add that the nails, like the shoe, should always be made of the best iron.

Driving the Nails.—In driving the nails into the hoof, every one should be made to pass through sound horn. It is a mistake to place them where the wall is broken or perforated by previous nails, as this only makes bad worse; and care should be taken to direct each nail so accurately, that it may make its exit at the desired point on the face of the wall at once.

Careless or unskilful driving of the nails necessitates their being withdrawn several times before they are properly implanted, and as each nail, however carefully it may be placed in the wall at the first attempt, is a source of injury by splitting asunder or perforating the fibres, it follows that when several attempts have to be made the injury is proportionately increased.

A short thick hold of the wall is better than a long thin one ; and, if possible, no more horn should be included within the grasp of the nail than is likely to be removed at the following shoeing. By this means the wall is constantly maintained sound.

A foot allowed to grow strong in the manner just described, will suffer no inconvenience in having the nails driven tightly into the shoe and hoof after they have been placed in their proper situation.

Where the hoof is thin, as at the quarters and heels of the fore foot, smaller and more slender nails must be used, and these must be less tightly driven. The nails at the front part or toe should be first hammered home firmly, then the quarter and heel nails gradually lighter. Every nail should form a part of the shoe, and the head should barely project above it : when all are solidly disposed, they must be tightly “ drawn up ” at the ends (the points having been twisted off previously) by means of the hammer and pincers, using the same graduated degree of force as in driving them home.

Conclusion of the Operation.—Nothing now remains to be done but to bend down, or “ clench,” the portion of nail so drawn up on the face of the wall. This should be accomplished by shortening the fragment to a proper length by the rasp, so as to leave just enough

to turn over ; the rasp also removes the small barb of horn raised in drawing up the nail, but without making a notch, and then the clench is laid down evenly. No more rasping or cutting should be allowed on any pretext whatever.

RASPING.—Very different to this treatment is that practised in many forges, where the front of the hoof is rasped as high as the coronet. Indeed, in books on farriery it is recommended that, though the wall ought not to be rasped above the clenches, this must be done below them : evidently ignorant of the fact that nearly as much, if not more, harm is done by this operation below than above these rivets.

Those who study what has been said relative to the structure of the wall of the hoof, will readily enough understand the amount of injury inflicted on the foot by this rasping.

Over the whole external face of this part there appears to be spread a fine translucent horn, which looks like a varnish, whose office, in all probability, is to prevent undue drying of the hoof, and consequent brittleness. Immediately beneath this are the dense resisting fibres of the wall, which are intended to sustain wear, and are best adapted to support a shoe, through the medium of the nails ; in fact, they are the fibres which ought to perform this duty, as beneath them, towards the inside of the wall, the horn rapidly becomes soft and spongy, and more like the pith of a rush.

In consequence of the farrier having neglected to remove a sufficient amount of horn from the lower margin of the wall, when preparing the foot for the

shoe, or through having nailed on a plate too small for the natural circumference of the hoof, a large piece of this solid material projects beyond the shoe, particularly in front and at the sides. This is torn away by the rasp, after the clenches have been laid down; and when this has been done what do we see? The wall of the foot, instead of coming down from the coronet to the shoe in all its integrity and evenness of slope, as soon as it reaches the clenches is chopped abruptly downwards, giving the foot a stump or club-like appearance, and greatly diminishing the extent of its bearing surface. The greatest evil, however, is the loss of the strong tough horn, whose presence is so necessary to protect the lower margin of the hoof, and afford support and hold to the nails.

In consequence of its removal, these have nothing to retain them but the thin pellicle of soft horn remaining, and this being so weak, and suddenly exposed to influences it was never intended to encounter, quickly dries up, shrivels, becomes brittle, and cracks or breaks away in flakes. Then we have a hoof deprived of its horn, and in as unnatural a condition as can well be imagined; it has been so mutilated as to require the greatest care, at the next shoeing, to place the nails in sound horn; the operation of rasping and curtailment being repeated each time increases the evil, and should a shoe chance to come off on the road—an accident, it may be inferred, extremely likely to happen—great damage will be done to the pared sole, and the thin, brittle, split-up wall, and in all probability, after a few yards' travelling, the animal will be lame.

The desire to make fine work of shoeing, when the horse was first shod, ends in the greatest amount of skill and labour being required to continue it, and to keep the animal to some extent fit for service ; though with deformed feet, seriously damaged horn, and perhaps lameness.

The truth of this can be verified by a casual glance at the hoofs of horses that pass us in town or country —though perhaps it is most conspicuous in town-shod horses.

One of the most serious results of this excessive mutilation of the lower part of the wall is the production of a chronic form of lameness, marked by slight subsidence half way down the front of the foot and, to a less degree, at the sides, with an abrupt rounded protrusion of the part that is always exposed to rasping.

This deformity, which induces pain and altered gait in the great majority of cases, arises from the irritation caused to the sensitive parts within, by the removal of their natural protection ; but more particularly from the fact, that the nails, to retain the shoe, must be driven through a sufficient amount of the soft horn, and this brings them so near the living parts that they press upon them, and to such a degree as to set up congestion of the foot. When the coachman, groom, or farrier's fancy causes the rasp to be carried above the clenches to the top of the hoof, then of course the injury is greatly aggravated.

The thin semi-translucent horn that extends in a somewhat wide, whitish-coloured band around the upper part of the foot, is by Nature chiefly intended to protect the fibres of the wall from the effects of

external physical influences, such as heat and dryness, while they are being secreted, or so immature as to be incapable of resisting these influences : for it will be remembered that the wall is formed at the coronet, and this covering guarantees not only the integrity of the newly formed horn tubes, but also assists in maintaining the secreting surface in a healthy condition.

The destruction of this band, and the rasping of the fibres beneath it, is detrimental to the healthy secretion of the wall horn, and leads to the same result that paring the sole has been shown to do : shrinking of the horn tubes containing the villi, and a thin brittle wall that scarcely appears to grow in depth or thickness, and barely allows a shoe to be attached to it. Sandcrack and other diseased conditions of this part of the hoof are also mainly due to this cause.

After applying the shoe in the manner we have described, and laying down the clenches evenly on the wall of the hoof, no more requires to be done, unless perhaps it be to round a little more the edge of the narrow shreds of horn that may project on each side of the clip, and thus prevent their liability to split. The angle of the face of the hoof should never be interfered with after the shoe is nailed on, but should be the same from top to bottom as in the natural state. This is a matter of great importance. Too much stress cannot be laid upon the preservation of the horn of the hoof in its integrity. No amount of rasping or artificial treatment can give the hoof the beautiful polish it has in its natural state.

Laying down Clips.—At this stage, it is usual to

apply the clip or clips more exactly and evenly to the hoof before completing the operation of shoeing; and even this apparently trifling matter demands care. With gradually decreasing blows of the shoeing hammer, each clip should be applied close to the hoof, commencing at the bottom, where it springs from the shoe, and ascending to its point. Clips should never be driven tight into the hoof; this is injurious and may induce disease.

When, in due course, the period arrives for re-shoeing—usually in about a month—the hoofs require to be reduced to their normal dimensions; then the rules we have laid down for guidance are to be followed out in the most scrupulous manner. The old shoe is to be *gently* removed from the foot, by carefully cutting away the clenches with the buffer; the pincers are to be inserted towards the heel, between the hoof and shoe, and the latter prized steadily *upwards from and across* the foot. When, by this means, the nails have been sufficiently sprung, they may be withdrawn one by one. Particular care must be taken that no clenches or broken nails remain in the hoof, as these are likely to turn the points of the succeeding nails into the living parts of the foot.

Such, then, on the one hand, is shoeing as it is sometimes practised, to the detriment of the horse, and, on the other hand, shoeing as it ought to be performed, so as to maintain the comfort and efficiency of this valuable animal.

It will be observed that no claim is here made to any wonderful novelty or discovery in the way of a shoe that will answer every purpose, and keep every

horse wearing it workably sound. Such an invention must be left to those whose practical experience is of the most limited character, and who assume that the evils of shoeing are concentrated in the metal plate alone. It may be sufficient to say, in this place, that so far as the comfort, utility, and well-being of the horse are concerned, the preservation of the foot in health by abstaining from mutilating and deforming it with knife and rasp, is of the highest importance. If this be done, the shoe most appropriate for certain purposes demands some attention, but is really a matter of minor consideration.

Preserve the hoof intact and strong, and the animal will travel long and soundly in a very uncouth foot armature; pare and rasp it according to "improved principles," and the most laboured, expensive, and artistic device in the form of a shoe will not prevent discomfort, disease, lameness, or premature uselessness.

The rational method here inculcated has been adopted by many farriers with great advantage. The preparation of the foot for the shoe has been restricted to levelling the wall in conformity with the direction of the limb and foot, and to removing as much of its margin as will restore it to its natural length, leaving the sole, frog, bars, and heels in all their integrity. Such has been the treatment of the hoofs of horses in various parts of the world, and in far more trying circumstances at times, so far as shoeing is concerned, than are likely to occur in the regular work of towns; and so strong were the hoofs, as a rule, such solid blocks of horn did they appear, that when a shoe was, by some rare chance, lost on a journey, there was no

danger whatever to be apprehended from marching the horse ten, twenty, or even thirty miles, without it. Horses have never been pricked in nailing, and foot diseases, it may be said, have been all but unknown. The roughest roads and the sharpest stones have been travelled over with impunity, and nearly every hoof might be taken as a model, and be pronounced as perfect as before the animal was shod many years previously.

This abstinence from paring and rasping, it will be seen, very materially lessens the time and labour required in the ordinary method; indeed, nothing can be simpler than the conservative principle of shoeing, and this simplicity can be effectively carried into practice with one-half the instruction and toil required for the popular mode.

VARIOUS OTHER METHODS OF SHOEING.—Other methods of shoeing have been devised from time to time, and may be referred to here.

To diminish the weight, and permit a portion of the posterior part of the foot to come in direct contact with the ground, along with the frog, a three-quarter shoe is often applied—the portion of iron extending from the inside quarter to the point of the heel being cut off, and the shoe at this part thinned a little. The horn left unprotected is never interfered with. This is an excellent shoe for saddle and carriage, and even draught horses, which may be employed on the worst roads while wearing it. For feet that have suffered very much from the effects of rasping and paring, and that are liable to have bruised heels (or corns), its use is attended with the greatest benefit;

though it possesses some faults which militate against its general adoption. .

The same may be said of "tips," or half-shoes. An unreasonable prejudice appears to exist against the use of these light, short plates; but if they are applied in appropriate cases, there can be no doubt whatever that they are entitled to a far larger share of attention than they have yet received. Their very limited employment hitherto, may have arisen from the imperfect manner in which they have been used. They protect those parts of the wall most exposed to wear—extending around the toe, and reaching no farther than the quarters; while the heels and frog, when left unparéd and unrasped, are strong enough to meet most demands made upon them, at the same time they are not deprived of their functions.

In addition to these considerations, the diminution in the weight of the shoe is a matter of some importance. It has been objected to "tips" that they cause too much strain to be thrown on the back tendons, from the front of the hoof being lengthened out of proportion to the heels. This is certainly the case; but with the majority of hoofs a little management in partially imbedding the crescent-shaped plate at the toe, and leaving the heels, frog, and quarters intact, will obviate to a large extent this harmful effect. They have been used, with advantage, on carriage and saddle horses, and the only objection that has been urged against their employment is that in some animals the horn of the hinder or unprotected parts of the foot wears away faster than it can be renewed, causing lameness or a shuffling gait.

Of course, the three-quarter shoe and the tip are only required for the fore feet; the hind-foot shoes, so long as they are level, are not too heavy, and do not wound the opposite limbs, may be of the ordinary pattern.

On this difference between the management of the fore and hind foot we cannot too much insist. The fore foot is much more disposed to disease and injury than the hind foot. So much is this the case, indeed, that the proper management of the first is all-important, while the other requires but little attention. The reason is that the horizontal body and long heavy neck and head of the horse cause the largest proportion of the weight to fall upon the front pair of supporting columns, and, through them, upon the feet: the fore limbs are those most concerned in supporting weight, the hind ones in propelling the body forwards. Hence the necessity for allowing as much of the lower face of the fore foot as possible to come in contact with the ground; and hence the prevalence of disease in it when improper shoeing weakens it or limits its points of contact to the narrowest dimensions.

Another form of shoe is that commonly known as the "BAR SHOE"—a ring or annular plate of metal, which increases the surface of contact by resting, to a large extent, on the frog, and allowing that important body to participate in weight-bearing; in this way it also relieves the heels when these are weak or injured. It is a very useful shoe, but the additional weight given to it by the bar, and the extra strain on the nails attaching it to the hoof, are drawbacks.

Preplantar Shoeing.—To apply a shoe in such a

manner as to allow the frog to receive full pressure, has always been the aim of those who have made the horse's foot an object of careful study. Even with the seated shoe, if it be not too thick or garnished with calkins, the frog, if unmutilated, in the large majority of cases will rest upon the ground for nearly the whole of its length, and will sustain beneficial wear. But this object, with others of importance, is perfectly attained in what has been designated the "periplantar or preplantar shoe and method of shoeing," introduced by Veterinary Surgeon Charlier, of Paris, in 1865. Leave the hoof entirely in its natural condition, so far as frog and sole are concerned, and imbed a narrow rim of iron around the lower margin of the wall from heel to heel—that part exposed to wear—in a similar manner to the sunk iron heelplate of a man's boot, and a fairly correct idea will be obtained of the periplantar or preplantar method of shoeing.

The principle on which this method of shoeing is based, is, physiologically, perfectly correct. Knowing that the horse's foot is admirably constructed to perform certain definite functions; that the hoof, in ordinary conditions, is designed to act as the medium through which the most important of these is carried out; and that its circumference is liable to be broken away or worn when unprotected or exposed: we have only to substitute, for a certain portion of this perishable horn, an equivalent portion of iron or steel, and the hoof is secured from damage by wear, while its natural functions remain unimpaired. As this novel method of shoeing has attracted much attention, and in many instances has proved beneficial and worthy

of more extensive adoption, a brief description will be given of the way in which it may be carried out in the forge.

The sole and frog, as well as the bars, are left unpared. The crust or wall is bevelled off at the edge by the rasp, and by means of a special knife with a movable guide, a groove or recess is made along this bevelled edge to receive the shoe. Charlier's knife had a fixed guide; so that no variation in the width of the recess for the iron rim was permitted. This was found to be a great defect, as the iron rim for a



FIG. 29.—A KNIFE DEVISED FOR PREPLANTAR SHOEING, FURNISHED WITH A MOVABLE GUIDE. The dotted lines show the extent to which the Guide can be moved forward.

small-footed horse or pony should not be so wide as that for a large draught or carriage horse. The great inconvenience resulting from the fixed guide on Charlier's knife, and the impossibility of making the shoe fit accurately around the margin of the sole (without which its stability is endangered), soon led to the introduction of a knife with a movable guide, which cuts a space of any width that may be necessary for the largest or the smallest rim.* This recess is made a little shallower than the thickness of the sole, and slightly narrower than the thickness of the wall,

* This knife is made and sold by Messrs. Arnold and Son, instrument makers, West Smithfield, London.

not extending beyond the white line separating the former from the latter (Fig. 30).

Into this groove is fitted the shoe. This is a narrow, but somewhat deep band of iron, or steel, or steel-faced iron, narrower at the top than the bottom, and forged in such a manner that its front surface follows the slope of the wall of the foot. It is perforated by from four to six oval nail-holes of small size, and if required may be provided with a clip at the toe,

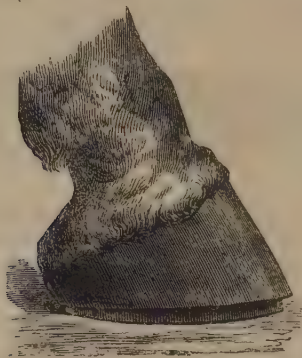


FIG. 30.—HOOF PREPARED FOR THE PREPLANTAR SHOE.

though this is seldom found necessary. Its upper inner edge is rounded by the file, to prevent it pinching the sensitive foot or pressing too much against the angle of the sole, and the ends of the branches are narrowed, and bevelled towards the ground (Fig. 31).

The nails are very small, and have a conical head and neck (Fig. 32). They must be of the finest quality.

It is best to fit the shoe in a hot state, as it must have a level bed and follow exactly the outline of the wall. After it has been fitted, it is advisable to

remove, by a small drawing knife, a little of the horn from the angle of the groove in the hoof, to correspond



FIG. 31.—THE FULL-LENGTH
PREPLANTAR SHOE.



FIG. 32.—THE PREPLANTAR
NAIL.

with the rounded upper inner edge of the shoe. This insures a proper amount of space between the latter and the soft horn next the pedal bone.



FIG. 33.—THE FULL-LENGTH PREPLANTAR SHOE attached to the
hoof.

In strong hoofs, the shoe is almost entirely buried in the groove ; but in hoofs which have a flat or convex

sole, with low heels, or which have been excessively pared, it is unwise to imbed it so deeply, at least at the first preplantar shoeing.

The application of the hot shoe in fitting should not extend beyond a very few seconds, and it should be pressed against the crust, or downwards, but never towards the border of the sole.

The shoe is nailed to the hoof in the ordinary manner



FIG. 34.—THE GROUND SURFACE OF A HOOF shod with the Full-length Preplantar Shoe.

(Fig. 33). For saddle and light carriage horses, four nails—two on each side—will be found sufficient to retain each shoe. The nails should be placed wide apart at the toe and rather close to the heel (Fig. 34, *a*, *b*). Every nail must be driven through sound horn, otherwise the shoe, being so narrow, may become twisted outwards; and nothing more is needed than to lay the clenches down evenly on the wall. No rasping of the front of the hoof is required, nor should it be allowed on any pretence. When the shoe has

been properly attached to a sound and strong foot, a portion of the sole and bars, and the whole of the frog, meet the ground as in the unshod state (Fig. 34).

By many, the short shoe (Charlier tip), about the length of an ordinary tip, is preferred to that which extends nearly to the heels; and in the majority of cases it will be found more serviceable, especially with horses used on land and at a quick pace—as hunters or racers. This shortened shoe has been employed with

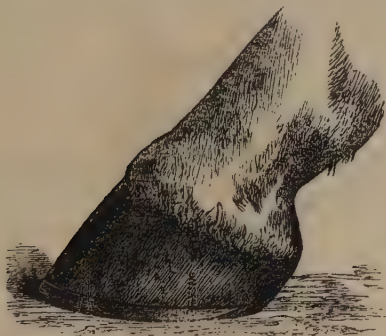


FIG. 35.—LATERAL VIEW OF A HOOF shod with the Short Preplantar Shoe.

marked success on hacks and carriage horses working regularly in town or country. In these instances, the groove or recess was not cut to the point of the heels, but only the length of the shoe; so that the wall beyond this stood on a level with the plate (Fig. 35). It is important to remember in this connection that horses with thin or low heels, or flat feet, are not likely to work satisfactorily when shod with Charlier tips.

The great advantages of this method of shoeing consist in its simplicity, when farriers have been made

to understand it; its placing the hoof in a natural condition, so far as its ground face is concerned; the small number and size of the nails required to retain it; the lightness of the shoe; and the security it gives the horse in progression. It cannot be applied indiscriminately to every foot, and to make the groove in the hoof, and to fit the shoe accurately, require considerable care. Short preplantar shoes or Charlier tips very quickly wear thin on hard roadways, and while



FIG. 36.—SHORT, GROOVED, STEEL-FACED PREPLANTAR SHOE.

they afford a good foothold on wood pavement and asphalt, sooner or later they induce fatigue of the flexor tendons, with slightly bent or shaky knees; the unprotected heels of the foot become rapidly worn, the horse loses action and exhibits tenderness or lameness on the trot. For hard, tough hoofs of good shape with strong heels Charlier tips are quite suitable, but as hoofs of this quality are the exception, this method of shoeing can hardly be expected to meet with general adoption.

With an ordinary amount of care, any intelligent workman can shoe horses in this fashion. The chief points to be attended to are, making the recess no wider than the metal rim, which is largely supported by the margin of the sole; punching the nail-holes with a fine-pointed *round* punch, so as to cut through as few of the fibres of the metal as possible; hammering the nail-heads to the same shape as the nail-holes; and allowing the shoe to cool gradually, instead of immersing it in water after it has been fitted hot.

The imbedding of the shoes should only be carried out by degrees in cases in which the soles are thin, and it may require some time before they can be



FIG. 37.—RASP FOR ASSISTING IN FORMING THE RECESS IN THE HOOF.

allowed to lie on a level with the sole. When the foot is to be re-shod, nothing more is necessary than deepening the recess to the extent the hoof has grown since last shoeing, and applying the new shoe, which, of course, should exactly correspond to the outline of this part of the horny case.

Though the shoe is more expeditiously and accurately fitted in a hot than a cold state; yet when necessity requires it, a tolerably satisfactory shoeing may be accomplished without applying the hot rim. This is facilitated by the fine rasp (Fig. 37), which completes the work of the knife by making the recess level and regular.

WINTER SHOETING

In such a variable climate as ours, it is not an easy matter to provide economically and successfully for the occurrence of frost and snow during the winter months, so far as shoeing is concerned. Some winters are so mild, that there is no necessity for making any difference in the shoe ; while others are so severe, and the roads are so slippery for a long period, that special contrivances must be found if the services of horses are to be continued.

To be generally useful, these appliances must be cheap, efficient, and simple.

The quickest, cheapest, but at the same time least durable of these, is the "frost-nail." This is nothing more than the ordinary horse-shoe nail, with the head larger than usual, and flattened gradually to a thin edge. Two or three of the nails are withdrawn from each side of the shoe, and replaced by the frost-nails. The heads may be flattened in different directions according to circumstances. Sometimes the heads are of steel, when of course they are more lasting. For short journeys, frost-nails are useful and easily available ; but as they only last for a brief period, and as their frequent renewal may injure the hoof to some extent, they are only used when the services of the horse are not likely to be in great demand for any length of time, or when the frost promises to be very transient. They are best adapted for saddle and carriage horses. To prevent injury to the hoof, and at the same time to obtain all the advantages of frost-nails,

in the winter season, extra holes may be punched in the shoe—one at the extremity of each heel, and one on each side of the toe. These nail-holes should be large, and stamped so obliquely outwards, that the frost-nails, when required, can be passed through them, and lapped firmly over the edge of the shoe, without interfering with the hoof. They may be made altogether of soft steel, the heads alone being tempered. This plan has been found most convenient and effective, as the hoof and shoe are not disturbed, and the nails can be renewed as often as may be necessary.

The usual plan is to remove the shoes from the hoofs, and provide them with sharpened calkins, and it may



FIG. 38.



FIG. 39.

be toe-pieces, also sharp. This is not a good expedient if it has to be often repeated, as the hoofs are damaged by the frequent nailing, the horses are apt to be lamed, and the shoes to become loose. It is for the time being, however, very effective. When the calkins and toe-pieces are only made of iron, and if the ground be not covered with a sufficient layer of snow to soften the tread to some extent, they soon become blunted, and the shoes then require to be taken off and the process repeated. To remedy this, if time permits, it is an excellent plan to weld in the calkin, or toe-piece, or on the face of the shoe, a piece of steel (Figs. 38, 39, *a*), which, when sharpened and tempered, lasts a very considerable time.

In sharpening the calkins, regard must be had to their situation—that on the outside heel may be flattened across the branch of the shoe (Fig. 40), but that on the inside must be drawn as much as possible from the outer margin of the branch (Fig. 41), in order to avoid bruises and wounds to the opposite foot.

The Canadian shoe, made of steel, concave on the ground surface, with the concavity forming a sharp edge on the margin, is very useful when there is a thick layer of ice with snow.

But perhaps the most useful, least hurtful, and expeditious method of making the horse efficient on ice-covered roads, is by the adoption of screw-studs.



FIG. 40.



FIG. 41.

For these, each new shoe at the commencement of the winter has a round hole punched in each heel, and another at the toe, if considered necessary. This is tapped, and into it is fitted, for ordinary wear, a flat-headed stud (Fig. 42), with a screw shank which is turned in with a key or wrench. These studs last for some time, and preserve the shoe from wear; when worn nearly to the level of the shoe, they are removed and replaced by new ones. Should frost set in suddenly, the flat-headed studs have only to be removed by the stableman when the horse is required, and sharp steel ones substituted. This can be done in a few minutes.

The usual shape of the sharp stud is that of a wedge, the screw portion being much smaller than that projecting beyond the shoe. This is a faulty formation, which frequently leads to the stud working loose and falling out, or breaking off at the neck, leaving the screw portion in the shoe.

For many years this defect has been avoided to a considerable extent by employing steel frost-studs of a conical or pyramidal shape, and having the portion screwed into the shoe as thick as that projecting from it (Fig. 43). This pattern is not at all liable to turn round and fall out on meeting the ground; while,

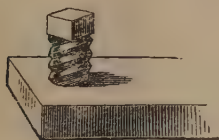


FIG. 42.—FLAT SCREW-STUD.

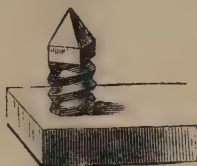


FIG. 43.—SHARP SCREW-STUD.

being the same thickness throughout, there is no check at the screw to weaken the stud; consequently it does not break if carefully forged and tempered.

Of all the appliances designed to enable horses to travel safely on ice, without taking them to the forge, or requiring the services of the farrier, none has stood the test of trial so satisfactorily as this screw-stud. Nearly every other contrivance introduced for this purpose has been found too complicated, or expensive in use, unfitted for severe exertion, or only adapted for shoes of one pattern.

Another form of frost-stud was suggested many

years ago by an officer of the Russian Army (Count Bachmeteff). This stud is simpler, more easily made, and much less expensive, though hardly more efficient than the screw-stud just described. It consists of a square piece of steel (about equal in length to the screw-stud), pointed and tempered at the end which rests on the ground, and flat at the end of the shank. This fits into a square hole made near the extremity



FIG. 44.—A SHOE, WITH THE UNSCREWED STEEL STUDS; one, shown within the shoe, has been removed from the aperture.

of each branch of the shoe, and, if thought desirable, at other points of each branch, or at the toe.

This hole should be very slightly tapering from the lower to the upper (or foot) surface of the shoe, and it should be of such a depth that the square stud will require a slight tap or two to make it fit in tightly, yet without projecting at all beyond the level of the foot surface. There was at first some doubt as to whether these studs would remain in position during

work, or while the horse was standing in the stable ; but on trial they were firmly retained in the shoes for a month, though subjected to every kind of test except on ice, which the season did not afford.

A few blows on each side are sufficient to slacken them, when they require to be removed as no longer necessary, when worn out, or when they require to be re-sharpened. The weight of the horse evidently keeps them tightly fixed in the shoe, and, from their being of the same thickness throughout, there is little risk of their breaking. It would be advisable to have the shoes a little thicker and broader at the places where the holes are to be made. This mode of rendering all kinds of horses efficient during frost will be found eminently successful and very inexpensive, and one readily carried out anywhere in a very short time.

SHOEING FOR DEFECTS IN LIMBS OR FEET

Shoeing is a powerful auxiliary in the hands of a competent farrier, for remedying the natural defects which are not unfrequently observed in the position of the limbs and feet of horses ; while to the scientific veterinary surgeon, it is no less a most useful aid in palliating certain deformities of a special character.

IN-TURNED AND OUT-TURNED TOES.—Perhaps the most frequent defects of the foot the farrier has to contend with, are in-turned and out-turned toes ; both of which malformations are not only unsightly, but are productive of more or less injury to the limb, from

the unequal manner in which some of its parts have to sustain the weight of the body.

To rectify the leg or foot when the toe turns outwards, the hoof should be levelled as before described, the margin of the wall at the outside toe, and back nearly to the quarter, being well reduced and rounded. The clip is to be drawn up nearer to the inside than the middle of the toe; the shoe to be fitted close to the outside toe and quarter, but the inside, from the quarter to the heel, should be more full than usual. In the course of several shoeings, by this reduction of the wall at the outside of the hoof, and the fitting of the shoe, a most noticeable improvement will be effected.

When the toe is turned inwards, precisely the reverse treatment must be followed: the inside toe must be reduced, the clip of the shoe formed nearer the outside toe, and the shoe itself fitted close at the inside toe, but wide at the outside. In both cases the shoes ought to be of the same thickness throughout.

“CUTTING,” or striking and wounding the inner side of the leg with the opposite foot, is sometimes a cause of lameness or of much annoyance. It may be due to weakness, fatigue, or to a sudden change in the manner of shoeing; in which cases it is only temporary. But it may also arise from malformed limbs or faulty action, and these defects may be so exaggerated as to be scarcely, if at all, remediable by shoeing alone.

The usual part of the hoof with which the horse strikes the opposite limb, is the inside toe or quarter. Whichever of these regions it may be, the hoof must

continue to be levelled at right angles to the direction of the pastern, and a shoe equally thick throughout applied, the only difference between it and the ordinary shoe being the removal of a portion of the iron from the margin at a point corresponding to the portion that causes the injury to the opposite limb; or the shoe, instead of being narrowed in the branch at this part, may be straightened, so as to lie within the hoof. No nails are to be inserted here; they may be placed in front of, and behind the striking portion—at the toe and heel. The hoof, after the application of the shoe, may then be reduced at the quarter with the rasp, to diminish its convexity, and thus avert “cutting” or striking. In many cases of cutting, immediate benefit will follow the application to the striking foot of a “blind-sided shoe”—that is, a plain shoe without nails in the inner branch. Sometimes a “feather-edged” shoe—one with the inner branch well bevelled towards the ground and fitted close to the foot—gives an excellent result, and in most cases of cutting a three-quarter shoe applied to the striking foot will prevent further injury. A lozenge-shaped piece of rubber inserted between the hoof and shoe at the striking part will lessen the effect of the blow, but further alteration of the shoeing is usually necessary to arrest the habit of cutting.

The preplantar method of shoeing is well adapted for certain horses that “cut.”

CAPPED ELBOW.—Some horses have the awkward habit of lying like a cow, with one or both fore legs doubled up at the knee, and the elbow resting on the heel of the foot. Should the ordinary shoes be worn,

it almost inevitably follows that the ends of the branches pressing upon the elbow will cause the formation of a large unsightly swelling, which may in time become indurated, or form an abscess. The prevention of this is in the hands of the farrier, who has only to shorten and smoothly round the extremities of the shoe, so as to keep them within the hoof. Most frequently it is the inside heel, in which case a three-quarter shoe at once remedies the evil or pre-

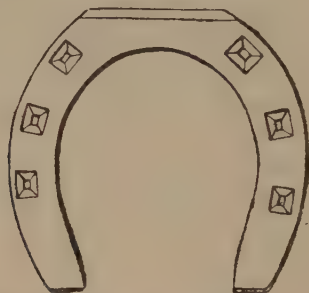


FIG. 45.—SQUARE-TOED SHOE FOR FORGING. (From Peuch and Lesbre's "*Pied du Cheval*.")

vents further bruising. In certain cases the addition of a bar-pad will be found advantageous.

FORGING.—Forging or clacking is applied to the noise produced by the toe of a hind shoe striking some part of the ground surface of a fore shoe. Slack-going and tired horses may forge when trotting or walking. The fault may be occasional or continuous, but generally it can be removed by altering the shoes. In slight cases immediate improvement may follow the application of a concave shoe to the fore foot and of a "square-toed" shoe to the hind one. By allowing

the hoof to project slightly beyond the toe of the hind shoe, which should have no calkins, the noise can be diminished, if not removed, but this expedient is not advisable in persistent forging, as the toe of the hind foot may suffer damage. A pneumatic rubber-pad applied to the fore foot will lessen the noise, and sometimes a "diamond-toed" shoe affixed to the hind foot will be found more successful than any other alteration in shoeing against forging.

FLAT FEET.—Flat sole is often associated with low, weak heels. The conformation of the foot is bad, and it may be natural in some horses, though frequently flat sole is the result of disease. In most cases, a half or three-quarter seated shoe, with or without a leather plate to protect the sole from injury, enables the horse to work satisfactorily. When the sole is thin, tender to percussion, and very prominent or convex, a narrow ($\frac{5}{8}$ to $\frac{3}{4}$ inch), thick shoe, deep enough to remove the sole from contact with the ground, and bearing on the wall and white line of the sole, will be found beneficial. and in cases where the heels and frog are fairly strong a narrow bar shoe of equal thickness throughout may be tried when the open shoe fails to afford the necessary relief.

CONTRACTED HOOFS.—Contraction usually is the result of disease, though it may be a consequence of excessive paring of the bars and frog, or of lameness which has caused the horse to rest the foot for a long time. Contraction is also symptomatic of side bone and of navicular disease. When this defect is unconnected with disease within the hoof, it may be palliated or completely removed by shoeing with tips,

or by turning the horse (unshod) out for a month or two. Expanding shoes are sometimes tried as a remedy, but jointed shoes designed to widen the hoof at the heels very seldom effect much improvement.

WIRED-IN HEELS.—This is a form of contraction in which the lower edge of the wall becomes incurved. It is often seen in feet with low, weak heels. The remedy consists in removing the incurved portion of wall and applying a bar shoe with a frog pressure bar to the foot.

GENERAL MANAGEMENT OF THE HORSE'S FOOT

After what has been said with regard to the management of the horse's foot in shoeing, there is but little to add concerning its general treatment; as shoeing influences, more or less, for good or for evil, the general condition of that organ, and renders its ordinary management either a matter of much or of trifling moment.

When it has been robbed of its horn by the farrier, and brought to such an artificial and abnormal state as we have indicated, then its preservation in anything like a healthy or efficient condition is a matter of no small difficulty, and appears sometimes to demand very curious, and often by no means reasonable, practices on the part of the stableman.

The most common are : applying to the face of the wall tar, oil, fish-oil, or advertised mixtures of various kinds to make the horn grow, prevent brittleness,

cure diseases, etc. ; and to the sole plates of leather, bolsters of tow steeped in tar, applications of cow-dung, mud or clay, and other materials.

It is scarcely necessary to say that to the unpared and unrasped hoof these are not only unnecessary, but some of them even positively hurtful. Oil, for instance, not only renders the wall brittle, but loosens the nails ; while cow-dung, from the ammonia it contains, softens and destroys the frog.

The unmutilated hoof is easily kept in health. All it requires is keeping cool, and moistening occasionally with cold water during hot weather, or after severe exertion. When a journey has been long continued and severe, the horse should not be immediately put into a stable, but ought to be walked gently about until the circulation of blood in the extremities has had time to accommodate itself to the altered conditions of rest. By this means congestion of the feet or laminitis (inflammation) may be averted.

In washing the hoofs a water-brush should not be employed, but a sponge, with a view to prevent the translucent horn (periople) on the front of the wall being destroyed.

The sides and cleft of the frog may be cleaned out occasionally with a blunt picker, though if sound this is scarcely required.

Nothing more is needed, so far as the every-day stable management of the foot is concerned, except to caution the groom against cutting away the hair immediately above the coronet, as this acts like a thatch in preserving the periople, at its commencement, from the effects of sweat and moisture.

Much harm is done to the legs and feet by the custom of keeping horses, while in the stable, constantly tied up in one position in stalls with sloping floors. This fashion is not only entirely opposed to the animal's natural habits—for the horse likes to move about and change his attitude—but the limbs and feet, more especially the front ones, are, instead of being rested, greatly fatigued ; and this brings about alterations which may be none the less serious because they are not immediate in their effects. Various injurious or unsightly habits may be acquired, such as crib-biting, weaving, wind-sucking, etc.

A loose box with a level floor, even if no larger than a stall, is infinitely preferable, and always to be commended to those who place some value on the soundness of body, eyesight, and limbs of their horses, as well as regard their comfort.

STREETS AND ROADS

The roads over which horses travel have also much influence for good or evil on the condition of the feet and legs. In the majority of the towns and cities in Great Britain, it would most certainly appear that considerations for the safety, comfort, or efficiency of the horses in daily use were altogether lost sight of, or neglected, in constructing the public thoroughfares.

Masses of hard and close-grained stone are laid down in most streets in such a fashion, that they seem as if purposely designed to afford an insecure foothold, and prevent the horse's strength being profitably

utilized. These paved streets—always a source of danger to the animals—while hindering them from employing their force to the best advantage, are also particularly injurious to the legs and feet from the incessant efforts made to maintain a footing. More especially is this the case in wet weather, when they are covered with greasy mud, and in summer when their dry smooth surface becomes *leaded*. It is needless to say, that no kind of metal defence to the hoof will for many days insure a firm foothold on such roads; and nothing but a metal defence has ever been found suitable to the horse's foot.

Every device has been tried to meet the demands for travelling with ease and safety on such paved streets, and none has proved entirely successful. Nor is it at all likely that future inventions will entirely meet these demands; the basalt or granite pavement, perfectly smooth, and offering a most insecure surface for fixing the foot during movement, is not at all adapted for horse traffic.

From the durability of these roads, they may be, to those who have to pay for their construction and maintenance, more economical than others on which horses can journey with ease and without risk of falling down; but they are far from being economical to those whose vehicles traverse them. A portion of the horse's motive power is devoted to maintaining his foothold, and the fear induced by this insecurity operates against what remains being applied as profitably as it ought to be. So that less is gained in the economy of construction and durability, and in the easier traction of vehicles, than is lost in the injury

done to the horse's extremities, and the waste of power required to maintain its equilibrium.

Even more injurious to feet and limbs is the slovenly and stupid method still prevailing in districts in this country of repairing macadamized roads by depositing angular stones in a loose rugged layer of uncertain depth, and compelling horses with vehicles to travel over them until the stones are imbedded in a very irregular manner in the ground. Such a practice is not only extremely short-sighted on the part of those who make or repair roads in this manner—as these roads can neither be durable nor very serviceable—but also deserves censure as being dangerous to horses. Not only is the labour in drawing a vehicle over such a surface immensely increased, and the horse's strength thereby unprofitably expended, but the unstable footing afforded by the loose masses of stone throws a great strain upon the legs and feet, and not unfrequently the animal is thrown down, and becomes seriously injured or blemished for life.

Taken in connection with our subject, the best mode of constructing and repairing our public thoroughfares and highways with a view not only to meet the convenience of motor-car owners, but to insure the safety and comfort of horses, is a matter that deserves serious attention. We may preserve and defend the horse's foot to the best of our ability in our forges and stables, but if the roads over which he travels are not adapted to his employment, our exertions on his behalf can only be partially successful.

Wood pavement, as now laid in many London streets, is an improvement upon every other kind

hitherto tried. It appears to be sufficiently elastic to relieve the horses' feet and limbs from the uncomfortable jar they experience on stone-made roads; it is comparatively noiseless; the traction is easy; and even when wet, it affords a fairly good foothold.

The chief *desiderata* in a roadway are, durability, cheapness in construction, noiselessness during traffic, easy traction, and secure foothold for the horses travelling upon it. All these qualities should be found in a good road; and it is to be hoped that the day is not far distant when the material and the method of utilizing it which will confer this great boon will be discovered.

INSTRUCTION OF FARRIERS

The foregoing instructions relative to shoeing horses are, in substance, those which the late Dr. Fleming was accustomed for many years to lay before the farriers of the different regiments in which he served, and with an amount of success which amply rewarded him for the trouble he took to see that they were carried into practice. He confessed that his own duties had been considerably lightened in the greatly diminished number of lame and unserviceable horses; that the work of the farriers had been shortened and simplified, and that by their being able to understand the reasons for acting as he desired, their intelligence was awakened and they took greater interest in carrying out his views.

In our army this is not always the case. The subject of farriery is often looked upon much as it is in

civil life—as a matter that concerns the farrier only, and tradition and routine extensively prevail. In saying this, however, there is no desire to insinuate that army veterinary surgeons are averse from giving their attention to a most important, though it may appear a minor, part of their duty. On the contrary, many of them do so, and with the greatest advantage to the service; but there is not the same encouragement offered either to veterinary surgeons or farriers, in this respect, as there is in Continental armies. In the French army, for instance, there are schools and professors of farriery, the most notable of these being at the cavalry school of Saumur. In these, the farriers are regularly trained to a uniform and approved system before being posted to different regiments, and direct encouragement is given to these men by the institution of competitions, in which the most successful are rewarded by medals or other prizes.

But not only does the French Government bestow some care in the advancement of farriery in the army; it also stimulates competition and improvement among the civilian farriers. So long ago as April, 1870, there was a *concours* of “*maréchalerie*” at Valence divided into two sections—a civil and a military—presided over by two special juries composed of eminent veterinary surgeons and professors.

At this *concours*, not only were models of shoes and shod hoofs exhibited, but the farriers—civil and military—were tested in the various operations of farriery on the spot, by shoeing saddle, carriage, and draught horses, draught and pack mules, and oxen.

In Belgium there are also *concours*, and farriers

who attend them receive instruction from properly qualified veterinary surgeons, who are authorized to grant certificates of proficiency.

These *concours* cannot but effect much good, by attracting attention to this very important subject, and encouraging good workmen.

In most countries where the veterinary schools are supported and controlled by the Government, the students are taught the principle and practice, and even the manual details, of shoeing, and this instruction is of great value to them in after life.

It is scarcely necessary to say that in this country nothing of the kind is attempted.

The Government does very little to improve or encourage veterinary science in any way; hence the unsatisfactory progress of this important branch of medicine and rural economy in Britain; and hence, also, the slow improvement of farriery, even in our cities and towns. With the exception of the shoeing competitions and the distribution of a few prizes to farriers at agricultural shows, the subject hardly receives public attention. Even at the veterinary schools the art of farriery is treated as of minor importance. The whole subject is dealt with in a few lectures, and chief consideration is given to pathological shoeing, the principles and practice of the art receiving scant consideration.

When the Veterinary Colleges are so indifferent to a matter so closely related to the comfort and efficiency of the horse, we cannot wonder that veterinary surgeons, as a rule, and farriers, take but little interest in shoeing.

The remedy for this, of course, should be, in the first place, applied to the teaching schools. The anatomy and physiology of the horse's foot, its management in health and disease, and the principles and practice of shoeing, ought to be thoroughly inculcated.

It would be most advantageous if, when this course was adopted, farriers could be prevailed upon to attend, and after due examination as to their competency to practise their art in a rational manner, they were to receive certificates of proficiency as in Belgium—these certificates carrying with them similar advantages to those that the diploma of surgery confers upon the surgeon.

In default of this, veterinary surgeons properly qualified for the duty, and possessing the necessary convenience and opportunity, might be induced to receive and instruct apprentices in farriery, granting them authorized certificates when judged to be fit to practise the art.

Agricultural shows should be more frequently utilized as centres for shoeing competitions amongst farriers who have been instructed in the districts in which the shows are held. Of course, it must be a *sine quâ non* that the instructors and judges should themselves understand the subject thoroughly.

These are the only means by which the art of farriery can be satisfactorily improved in this country, where nearly all improvement is left to private enterprise. A profound knowledge of the anatomy and physiology of the horse's foot is not absolutely necessary to the farrier. What has been sketched out on these subjects in this essay should be found sufficient to enable

farriers to comprehend the nature of the organ they are called upon to protect and preserve, and this much can be easily taught them in a short time. Generally, more difficulty is experienced in making them unlearn their unreasonable practices, than acquiring those which are novel, though easier ; and the chief antagonists in all improvements have always been found amongst the more ignorant grooms and stablemen—the lovers of well-pared and rasped hoofs, oiled or blacked like a boot ; hot stables ; physic ; bearing-reins ; blinkers ; cruppers ; powerful bits ; and other things that are unnatural and injurious to the horse. But, as a class, stablemen, within recent years, have much improved in their knowledge of horse management ; many of them are most excellent, intelligent, and trustworthy, and the welfare of the horses entrusted to their care is now fully assured.

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